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Report on

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

JULY 1952 - JUNE 1956

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2	Area of Weather Modification Operations (4 sheets)

APPENDIXES

A.	Chapter 4, Division 1 of the Water Code
B.	Administrative Forms

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

July 1952 through June 1956

Introduction

The State Legislature, in July 1951, enacted legislation (Chapter 1677, Statutes of 1951) for the regulation and licensing of artificial weather modification operations in California. This act, which was codified in 1953 as Chapter 4, Division 1 of the Water Code, provides that the Department of Water Resources* shall regulate, control and encourage scientific experimentation in the field of artificial nucleation in order to develop, conserve, and protect the natural water resources of the State and to safeguard life and property.

Appropriate procedures have been established for administration of the act. Licenses to engage in artificial nucleation operations are issued upon proper application and payment of fees. All proposed projects are publicized and recorded with the Department. Licensees are required to maintain adequate records and to file suitable reports with the Department. These administrative procedures are presented herein.

Complete records of weather modification operations throughout the State since 1951 are available in the files of the Department. A compilation of these operations for the period July 1952 through June 1956 is included in this report. Data on prior operations has been published in State Water Resources Board Bulletin No. 16 "Weather Modification Operations in California," June 1955.

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* The Department of Water Resources was vested with all powers and duties of the State Engineer pertaining to artificial nucleation operations effective July 5, 1956, pursuant to Sec. 153, Chap. 52, Statutes first extra session 1956.

Administrative Procedures

The statutory provisions regarding artificial weather modification operations are found in Chapter 4, Division 1 of the Water Code "Regulation of Rain-Making and Rain-Prevention," included herein as Appendix A. Following are the procedures that have been established for administration of this chapter.

Any person desiring to engage in artificial weather modification operations must secure a license from the Department. Application for license must be submitted on Form 265 "Application for License to Engage in Operations to Modify Natural Precipitation by Artificial Means," and accompanied by a filing fee in the amount of $50. A license is valid for the calendar year in which granted; and can be renewed annually upon application and payment of a renewal fee of $25.

All projects must be adequately publicized. The licensee is required to file with the Department, and cause to be published, a notice of intention prior to initiating actual operations. The nature, location, time, and scope of the contemplated project should be indicated in the notice, which may be in substantially the following form:

NOTICE OF INTENTION TO MODIFY
NATURAL PRECIPITATION BY ARTIFICIAL MEANS

NOTICE IS HEREBY GIVEN, THAT - - - - (Name of Licensee) - - - - of - - - -(address in full) - - - -, who holds License No. ***** of the State of California to engage in operations to modify natural precipitation by artificial means, for and on behalf of - - - - (retaining organization) - located at - - - - (address in full) - - - - -, will conduct a program of weather modification - - - -(give nature and object of intended operation) - - - - as follows:

1. Area in which equipment will be operated --- (describe) ---
2. The target area will be - - - - (describe) - - - -.
3. Area adjacent to target area which may be subject to effects of operation will be - - - - (describe) - - - - -.

The operation will extend over the period from about - - - - - to about - - - - - - - - - - - - - - - - -.

Dated: (signed) _____

The notice should be published in local newspapers at least once a week for three consecutive weeks, and proof of publication filed with the Department within fifteen days from date of last publication. The Department may, at its discretion, grant permission to a licensee to undertake emergency nucleation operations without prior publication of notice of intention, if deemed necessary or desirable to aid in extinguishment of fires, or for alleviating drought emergency.

It is incumbent upon each licensee to maintain records of his operations. Immediately upon completion of each project, a report must be filed with the Department setting forth details of the operation. Form 273 "Completion Report by Licensee" is furnished for this purpose. An evaluation of the results of each operation, including an estimate of the gain or loss in precipitation attributable to nucleation activities and supporting data therefor is also required. The licensee may utilize Form 274 "Weather Modification Evaluation Statement" for this report, and may augment or amplify the data submitted with a copy of any other evaluation report prepared for the client or otherwise.

Copies of the several aforementioned forms are presented as Appendix B to this report.

Summary of Operations

In 1951, the year that the licensing requirement went into effect, eight licenses were issued, and a total of seventeen have been granted to date. At present eleven of these licenses are effective, including four that date back to the first year of regulation. These are listed in Table 1, which also indicates the calendar years during which each was valid.

TABLE 1

WEATHER MODIFICATION LICENSES ISSUED UNDER
PROVISIONS OF CHAPTER 4, DIVISION 1 OF THE WATER CODE

License number	Licensee	Valid for calendar year 1951	1952	1953	1954	1955	1956
1	North American Weather Consultants c/o W. L. Woolley Santa Barbara Municipal Airport Goleta, California	x	x	x	x	x	x
2	Santa Ana River Weather Corporation c/o Clayson & Stark First National Bank Building Corona, California	x	x				
3	John A. Battle Weather Modification Company Investment Bldg., Redlands, Calif.	x	x	x			
4	California Electric Power Company 3771 8th St., Riverside, Calif.	x	x	x	x	x	x
5	Water Resources Development Corp. 460 S. Broadway, Denver 9, Colo.	x	x	x	x	x	x
6	Weather Modification Company San Jose Municipal Airport San Jose, California	x	x	x	x	x	x
7	Precipitation Control Company 2431 East Buchanan Street Phoenix, Arizona	x	x				
8	P. J. Murray 701 G St., Oxnard, Calif.	x	x				
9	Placer County Farm Labor Cooperative, Inc. Newcastle, California		x	x			
10	Jack M. Hubbard Pole to Pole Weather Investigations Weather Projects, Inc. Rt. 7, Box 278A, Olympia, Washington		x	x	x	x	
11	Kenneth R. Perry 250 Del Medio Ave., Palo Alto, California	x	x	x	x	x	x
12	David D. Merrill, dba Precipitation Control Company of California 105 Pierce St., Taft, Calif.			x	x	x	x

TABLE 1

WEATHER MODIFICATION LICENSES ISSUED UNDER
PROVISIONS OF CHAPTER 4, DIVISION 1 OF THE WATER CODE
(Continued)

License number	Licensee	Valid for calendar year				
		1951	1952	1953	1954	1955	1956
13	Nofog Corporation 210 35th St., Richmond, Calif.				x	x	x
14	North American Weather Consultants of California c/o W. L. Woolley Santa Barbara Municipal Airport Goleta, California					x	x
15	Walter Floyd Jones 1704 Dixie Drive Porterville, California					x	x
16	OX Cattle Corporation P. O. Box 585 El Centro, California						x
17	Department of Natural Resources Division of Forestry State Office Building No. 1 Sacramento, California						x

Weather modification operations have been conducted throughout the State from Modoc and Siskiyou Counties on the north to Orange and San Diego Counties on the south. Most of the activity, however, has been concentrated along the westward slopes of the Sierra Nevada. Much of the work has been sponsored by public utilities to increase precipitation on the watersheds above their hydroelectric installations, although hail prevention and dissipation of lightning to decrease the incidence of forest fires have also been objectives.

A number of chemicals have been utilized as nucleating agents. Among these are silver iodide (AgI), dry ice (CO_2), salt (NaCl), and titanium tetrachloride ($TiCl_4$). The process most frequently used involves the creation of smoke plumes by burning silver iodide-impregnated coke in ground generators.

Weather modification projects in California during the four-year period July 1, 1952 to June 30, 1956 are listed in Table 2. A daily log of operations is presented as Plate 1 and their locations are delineated on Plate 2. These operations are grouped by runoff years (July 1 to June 30) and each is designated by a compound number consisting of three components. The first element is the license number, the second indicates the year of operation, and the third is assigned in numerical sequence to the several projects undertaken by a licensee during a runoff year as shown by notices of intention filed with the Department. As previously mentioned, records of weather modification operations in California conducted prior to July 1, 1952 are presented in State Water Resources Board Bulletin No. 16, "Weather Modification Operations in California".

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956

Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1952 - 53 Season				
1-53-1	North American Weather Consultants	Southern California Edison Company	Fresno and Madera Counties	Aug. 28, 1952 to Sep. 27, 1953	AgI	2,298	
1-53-2	North American Weather Consultants	Pacific Gas & Electric Company	Stanislaus and Mokelumne River Basins	Feb. 28, 1953 to May 27, 1953	AgI	1,147	
1-53-3	North American Weather Consultants	Santa Barbara County Water Agency	Santa Barbara County	Dec. 16, 1952 to Apr. 30, 1953	AgI	1,499	
4-53-1	California Electric Power Company	California Electric Power Company	Bishop Creek area near Bishop	May 14, 1953 to Nov. 14, 1953	CO_2	-----	
6-53-1	Weather Modification Company	San Diego County Weather Corporation and Santa Ana River Weather Corporation	Imperial, Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties	Nov. 6, 1952 to May 15, 1953	AgI	1,860	
6-54-1	Weather Modification Company	F.W. Gorham and Associates	San Benito, Fresno, and Monterey Counties	Mar. 12, 1953 to Apr. 29, 1953	AgI	56	
9-53-1	Placer County Farm Labor Cooperative, Inc.	Placer County Farm Labor Cooperative, Inc.	Area in Placer County from Lincoln to American River, and bounded by City of Rocklin on west and Clipper Gap on east.	Mar. 16, 1953 to June 7, 1953	CO_2 and NaCl	353	Hail Prevention
10-52-1	Jack M. Hubbard	Coast Redwood Company	Coastal area between Cape Mendocino and Crescent City	Aug. 9, 1952 to Sep. 7, 1952	AgI and $TiCl_4$	1,358	Extinguishing forest fires

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956
(continued)

Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1953 - 54 Season				
1-54-1	North American Weather Consultants	Southern California Edison Company	San Joaquin River drainage, upstream from Big Creek hydroelectric plants	Oct. 18, 1953 to Apr. 30, 1954	AgI	3,050	
1-54-2	North American Weather Consultants	Pacific Gas and Electric Company	Watershed of Crane Valley Reservoir and South Fork Willow Creek in Madera County	Jan. 3, 1954 to Apr. 30, 1954	AgI	954	
1-54-3	North American Weather Consultants	Pacific Gas and Electric Company	Watersheds of Mokelumne, Bear and upper Stanislaus Rivers	Dec. 3, 1953 to Apr. 29, 1954	AgI	2,122	
1-54-5	North American Weather Consultants	Pacific Gas and Electric Company	Drainage areas of Lake Almanor, Butte Valley Reservoir, and Mountain Meadows Reservoir	Mar. 8, 1954 to Apr. 28, 1954	AgI	662	
4-54-1	California Electric Power Company	California Electric Power Company	Eastern slope of Sierras from Lone Pine to Conway Summit	Dec. 16, 1953 to Jul. 17, 1954	CO_2	1	
5-54-1	Water Resources Development Corporation	Placer County Farm Labor Cooperative	Parts of El Dorado, Placer, and Nevada Counties	Mar. 31, 1954 to Jun. 15, 1954	AgI	2,246	Hail prevention
5-54-2	Water Resources Development Corporation	Rogue River Valley Traffic Association	Northern part of Siskiyou County	Apr. 26, 1954 to Sep. 16, 1954	AgI	519	Hail prevention - target area in Oregon
6-54-2 and 6-54-3	Weather Modification Company	San Diego County Weather Corporation and Santa Ana River Weather Corporation	San Diego, San Bernardino, Riverside, and Orange Counties	Nov. 2, 1953 to Mar. 30, 1954	AgI	778	
11-54-1	Kenneth R. Perry	Division of Forestry, State of California	Shasta, Trinity, Lassen, Modoc, Siskiyou, Plumas, and Butte Counties	Aug. 1, 1953 to Sep. 16, 1953	---	17	Forest fire prevention by lightning dispersion.

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956
(continued)

Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1953 - 54 Season (continued)				
11-54-2	Kenneth R. Perry	Division of Forestry, State of California	Sierra Nevada Mountains, east of Porterville	Aug. 12, 1953	---	2	Forest fire prevention by lightning dispersion.
12-54-1	David D. Merrill, dba Precipitation Control Company of California	Southern Sierra Corporation	Sierra Nevada Mountains between Porterville and Bakersfield, east of Highway 65	Jan. 6, 1954 to Mar. 22, 1954	AgI	50	
12-54-2	David D. Merrill, dba Precipitation Control Company of California	County of Kern and landowners	Northwest corner of Kern County	Nov. 13, 1953 to Apr. 28, 1954	AgI	96	
13-54-1	Nofog Corporation	Nofog Corporation					Not reported
			1954 - 55 Season				
1-55-1	North American Weather Consultants	Southern California Edison Company	San Joaquin River above Big Creek hydroelectric plant	Oct. 29, 1954 to Jun. 17, 1955	AgI	4,148	
1-55-2	North American Weather Consultants	Pacific Gas and Electric Company	Watershed of Crane Valley Reservoir and South Fork Willow Creek in Madera County	Nov. 29, 1954 to May 31, 1955	AgI	1,358	
1-55-3	North American Weather Consultants	Pacific Gas and Electric Company	Drainage areas of Lake Almanor, Butte Valley Reservoir, Mountain Meadows Reservoir, in Shasta, Tehama, Plumas and Lassen Counties	Dec. 1, 1954 to May 30, 1955	AgI	3,122	
1-55-4	North American Weather Consultants	Pacific Gas and Electric Company	Mokelumne River watershed, including Bear and upper Stanislaus Rivers	Nov. 29, 1954 to May 31, 1955	AgI	3,727	

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956
(continued)

Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1954 - 55 Season (continued)				
1-55-5	North American Weather Consultants	Water Research Association	Cummings, Brite, and Tehachapi Valley watersheds	Jan. 30, 1955 to May 8, 1955	AgI	878	
1-55-7	North American Weather Consultants	Santa Barbara County Water Agency	South Coast area and Santa Ynez Basin of Santa Barbara County, Cuyama Valley and mountains south	Jan. 17, 1955 to Apr. 30, 1955	AgI	1,026	
4-55-1	California Electric Power Company	California Electric Power Company	Bishop Creek watershed	Dec. 23, 1954 to Apr. 19, 1955	CO_2	-----	
5-55-1	Water Resources Development Corporation	Placer County Farm Labor Cooperative	Parts of El Dorado, Placer and Nevada Counties	Mar. 28, 1955 to Jun. 15, 1955	AgI	4,228	Hail prevention
6-55-1	Weather Modification Company	County of Santa Clara	Santa Clara County	Dec. 31, 1954 to Mar. 10, 1955	AgI	427	
6-55-2	Weather Modification Company	Santa Ana River Weather Corporation	Santa Ana River watershed and San Diego County	Nov. 1, 1954 to Apr. 4, 1955	AgI	2,195	
6-55-3	Weather Modification Company	Kings River Conservation District.	Parts of Fresno and Tulare Counties	Jan. 10, 1955 to May 1, 1955	AgI	812	
12-55-1) 12-55-3) 12-55-4) 12-55-5)	David D. Merrill, dba Precipitation Control Company of California	Southern Sierra Corporation	Eastern Tulare County and area east of Bakersfield in Kern County	Nov. 10, 1954 to May 8, 1955	AgI	123	
12-55-2	David D. Merrill, dba Precipitation Control Company of California	County of Kern	Northwest corner of Kern County	Nov. 10, 1954 to Apr. 30, 1955	AgI	120	

TABLE 2

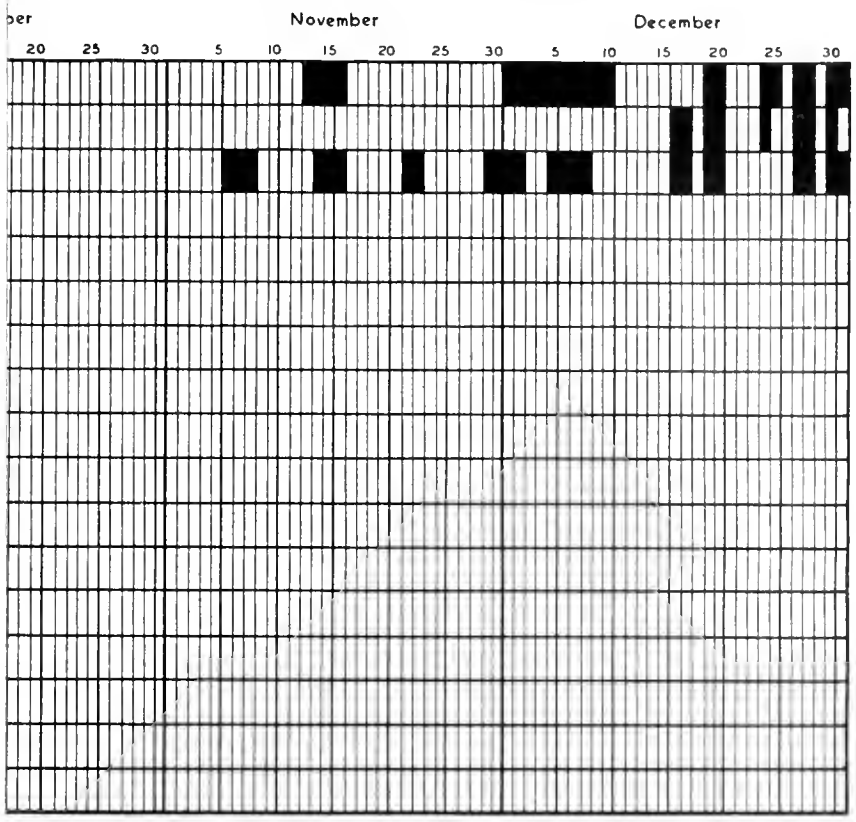
WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956
(continued)

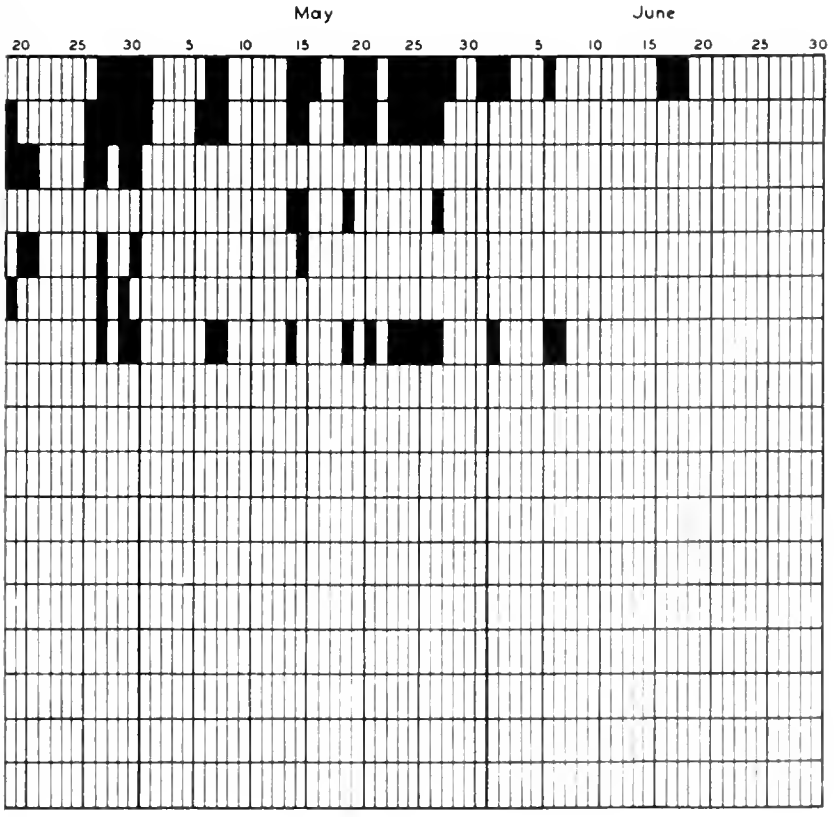
Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1955 - 56 Season				
5-56-1	Water Resources Development Corporation	Placer County Farm Labor Cooperative	Parts of El Dorado, Placer and Nevada Counties	Mar. 31, 1956 to Jun. 19, 1956	AgI	8,862	Hail prevention
5-56-2	Water Resources Development Corporation	Rogue River Valley Traffic Association	Northern part of Siskiyou County	Mar. 30, 1956 to Oct. 13, 1956	AgI	7,408	Hail prevention - target area in Oregon
6-56-1	Weather Modification Company	Santa Ana River Weather Corporation	Santa Ana River watershed	Nov. 12, 1955 to Apr. 14, 1956	AgI	10,675	
6-56-2	Weather Modification Company	Kings River Conservation District	Kings River watershed	Nov. 13, 1955 to Apr. 27, 1956	AgI	2,796	
6-56-3	Weather Modification Company	California Electric Power Company	Bishop Creek watershed	Nov. 12, 1955 to Jul. 24, 1956	AgI and CO_2	39	
6-56-4	Weather Modification Company	County of Santa Clara					Not reported
12-56-1	David D. Merrill, dba Precipitation Control Company of California	Kern County Board of Supervisors and landowners	Northwest corner Kern County and Kern River watershed	Nov. 13, 1955 to Apr. 26, 1956	AgI	104	
13-56-1	Nofog Corporation	Nofog Corporation					Not reported
14-56-1	North American Weather Consultants of California	Pacific Gas and Electric Company	Upper watersheds of Stanislaus, Mokelumne and Bear Rivers	Nov. 18, 1955 to Dec. 19, 1955	AgI	1,339	

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1952 - June 30, 1956
(continued)

Operation number	Licensee	Client	Area	Period of operation	Nucleating agent	Total generator hours	Remarks
			1955 - 56 Season (continued)				
14-56-2	North American Weather Consultants of California	Pacific Gas and Electric Company	Watershed of Crane Valley Reservoir, including North and South Forks of Willow Creek	Nov. 16, 1955 to May 11, 1956	AgI	1,302	
14-56-3	North American Weather Consultants of California	Pacific Gas and Electric Company	Watersheds of Lake Almanor, Butte Valley Reservoir, and Mountain Meadows Reservoir	Nov. 18, 1955 to May 11, 1956	AgI	1,877	
14-56-4	North American Weather Consultants of California	Southern California Edison Company	Watershed of South Fork, San Joaquin River	Oct. 26, 1955 to May 22, 1956	AgI	2,300	
15-56-1	Walter Floyd Jones	Southern Sierra Corporation	Kern and Tulare Counties, between Highway 99 and Sierras, north of Highway 466.	Nov. 13, 1955 to Apr. 27, 1956	AgI	400	





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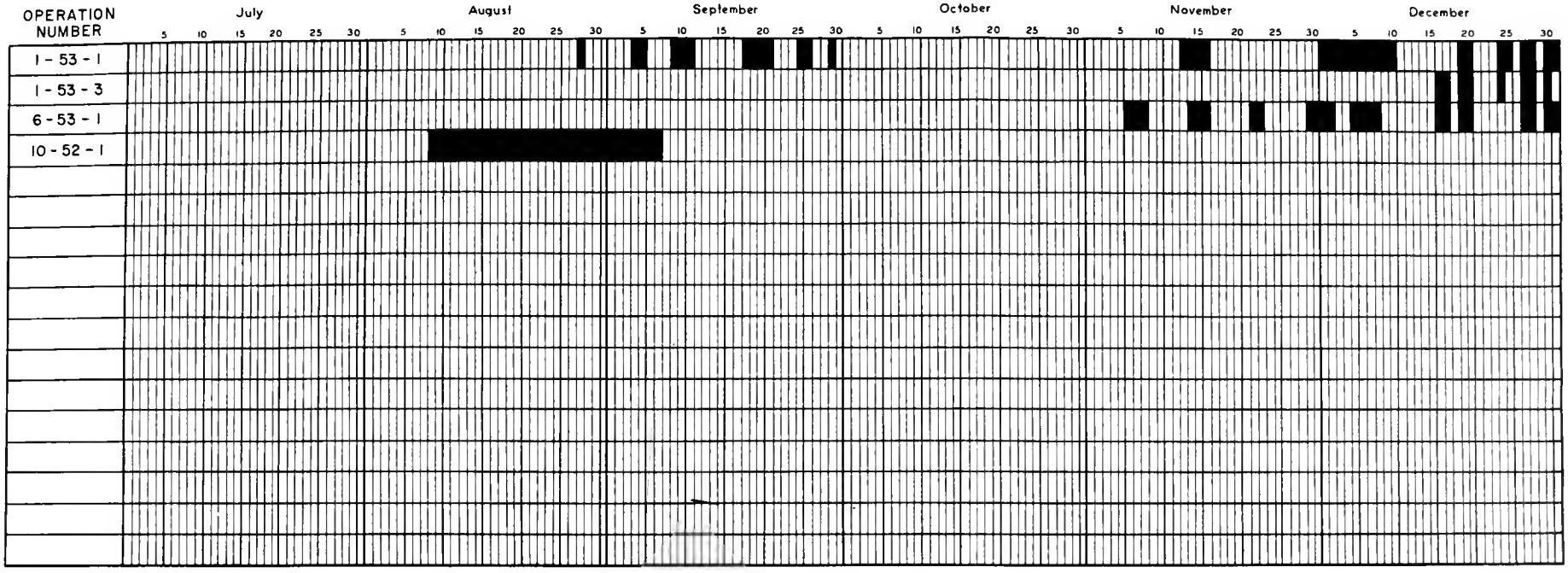
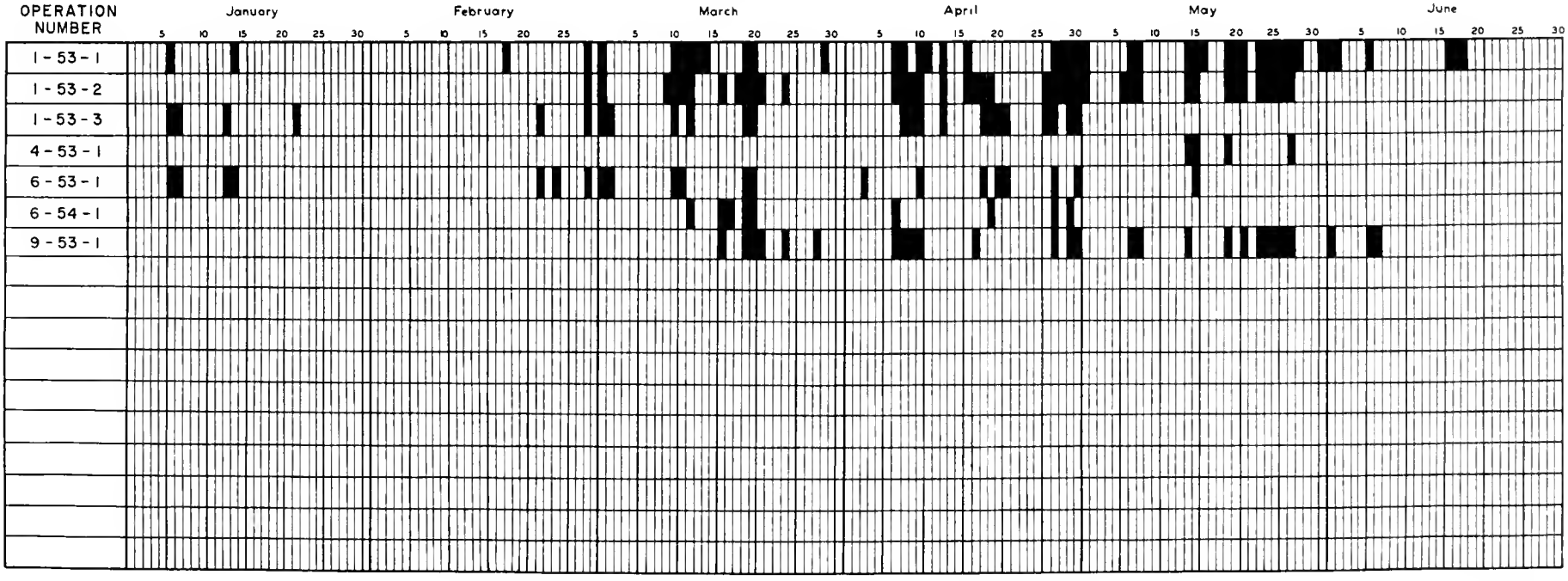
1952 - 53
SEASON

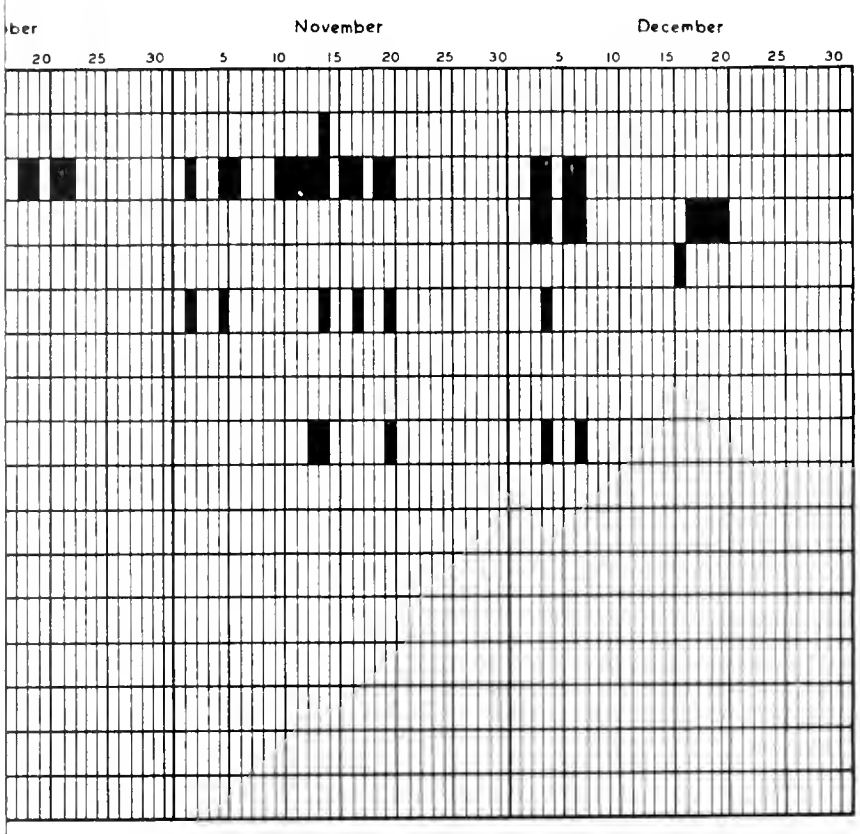


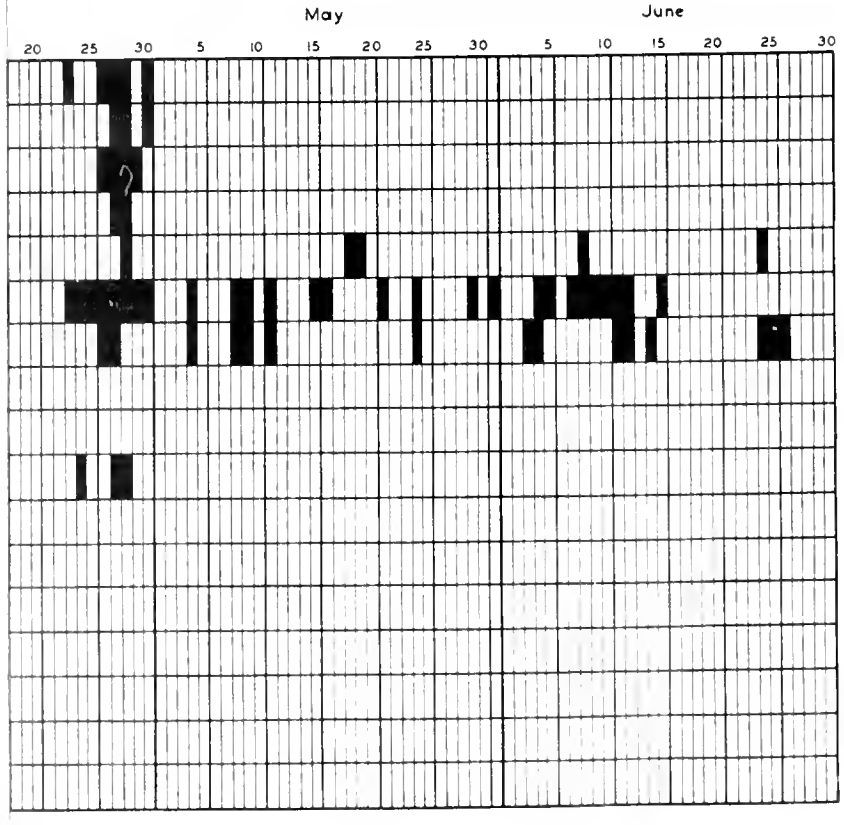


LOG OF WEATHER MODIFICATION OPERATIONS

1952 - 53
SEASON

DEPARTMENT OF WATER RESOURCES, 1957





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1953 - 54
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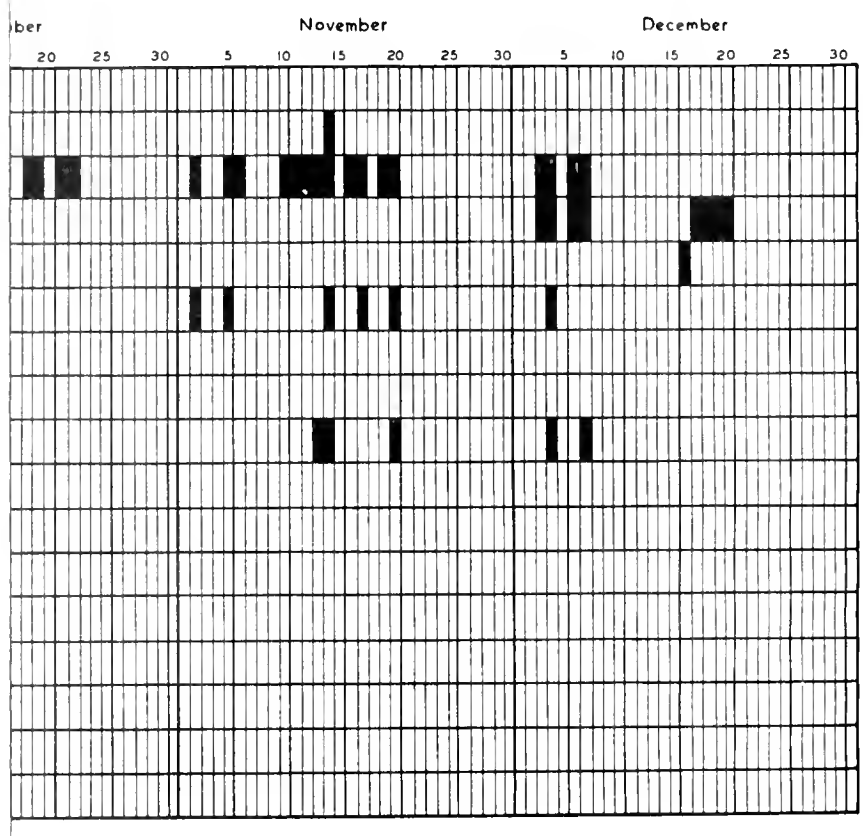

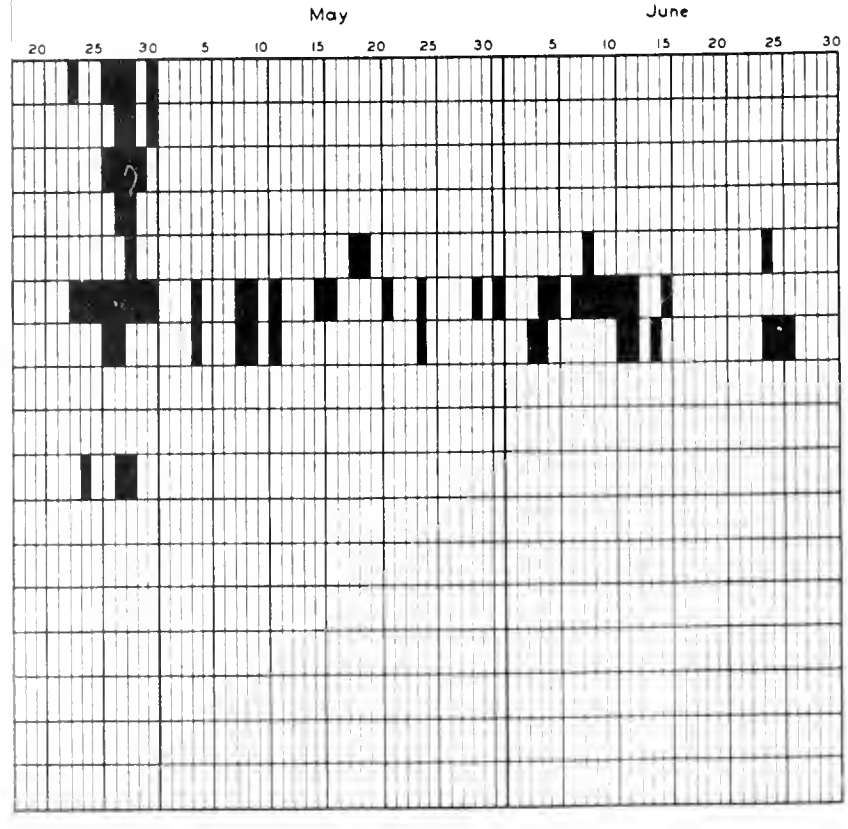

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1953 - 54
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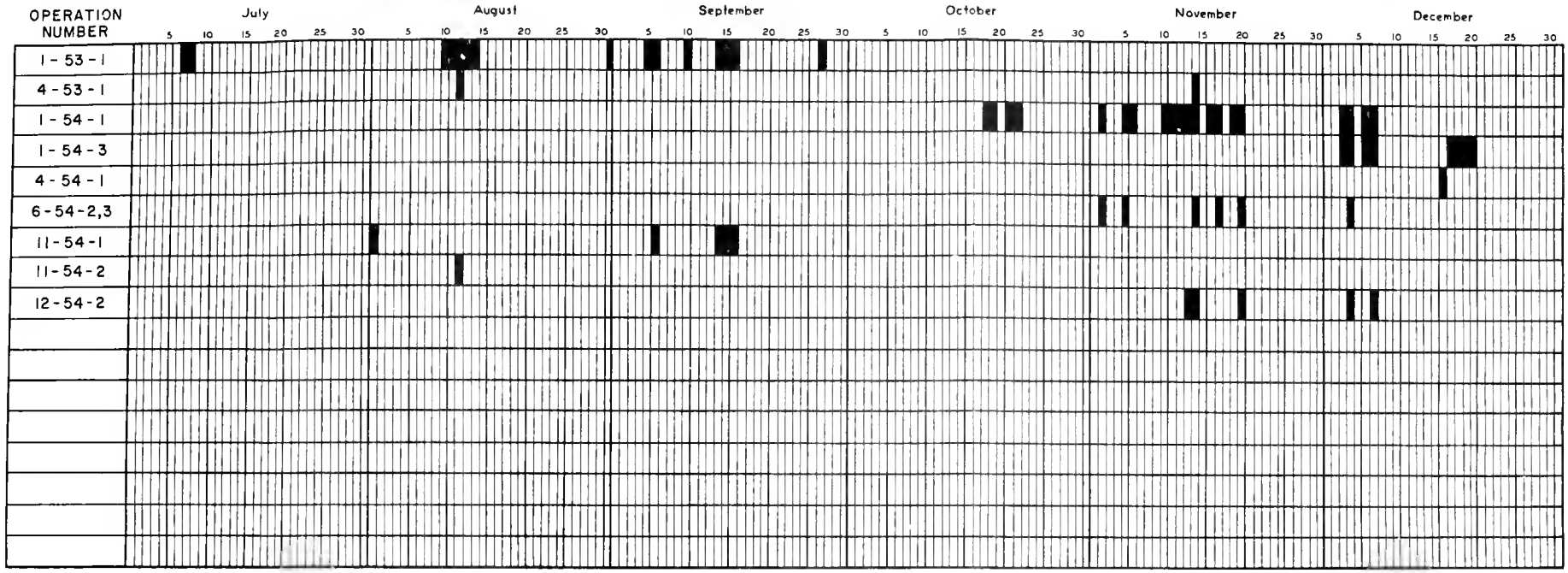
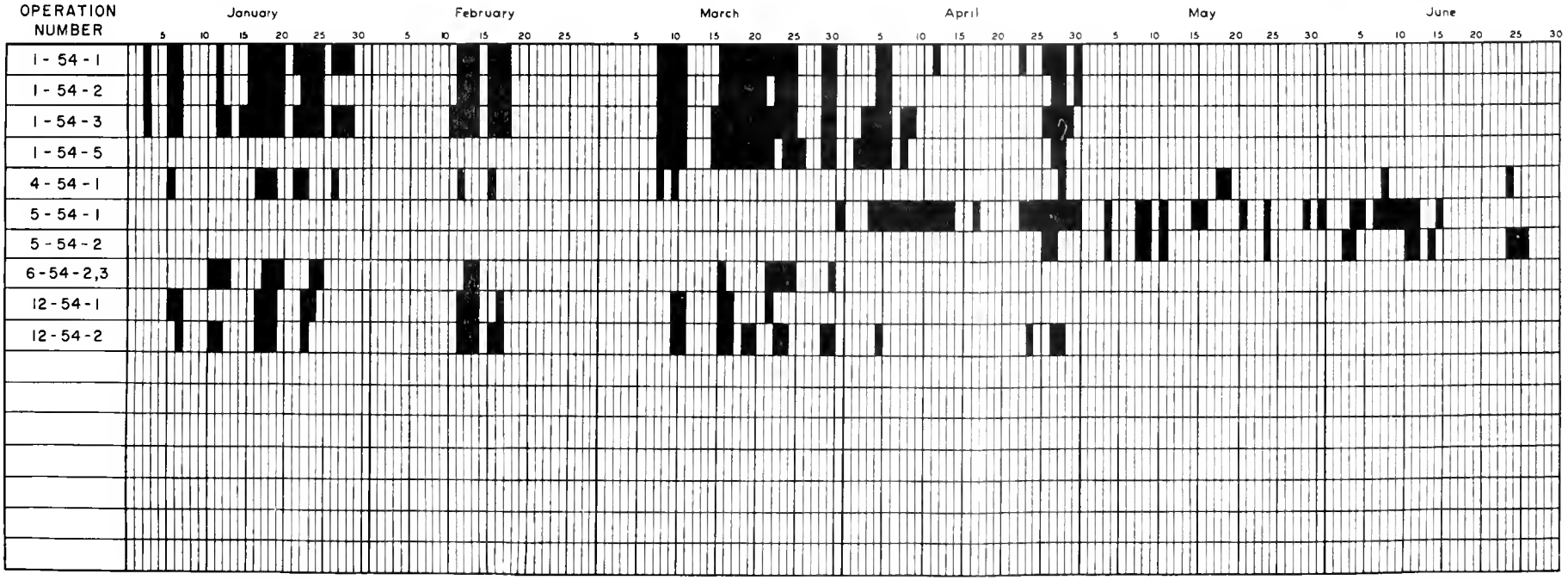
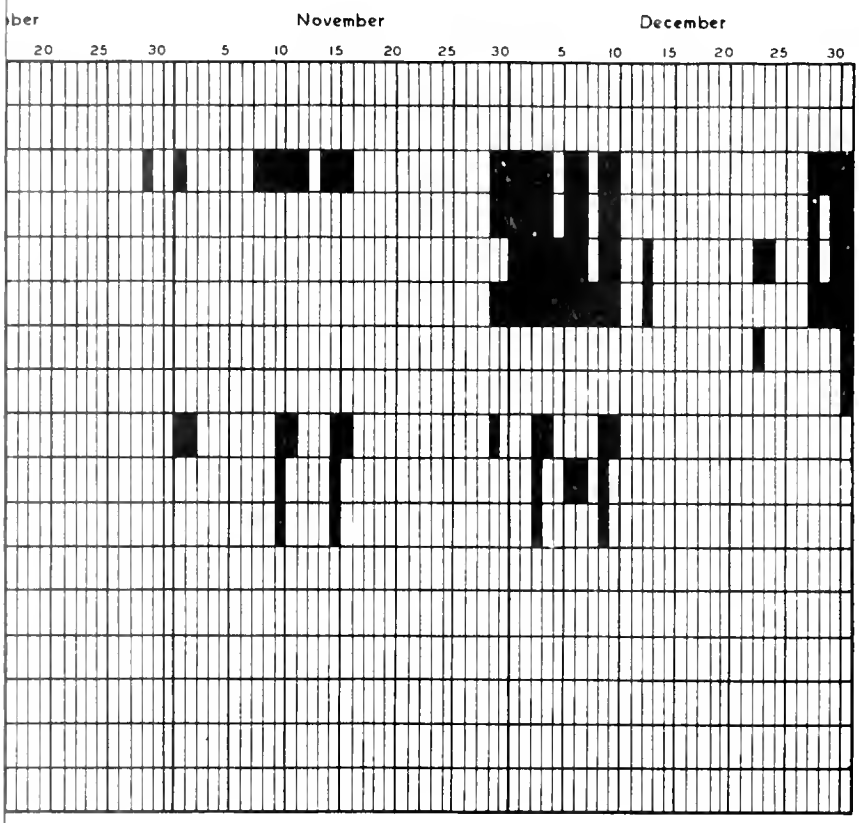
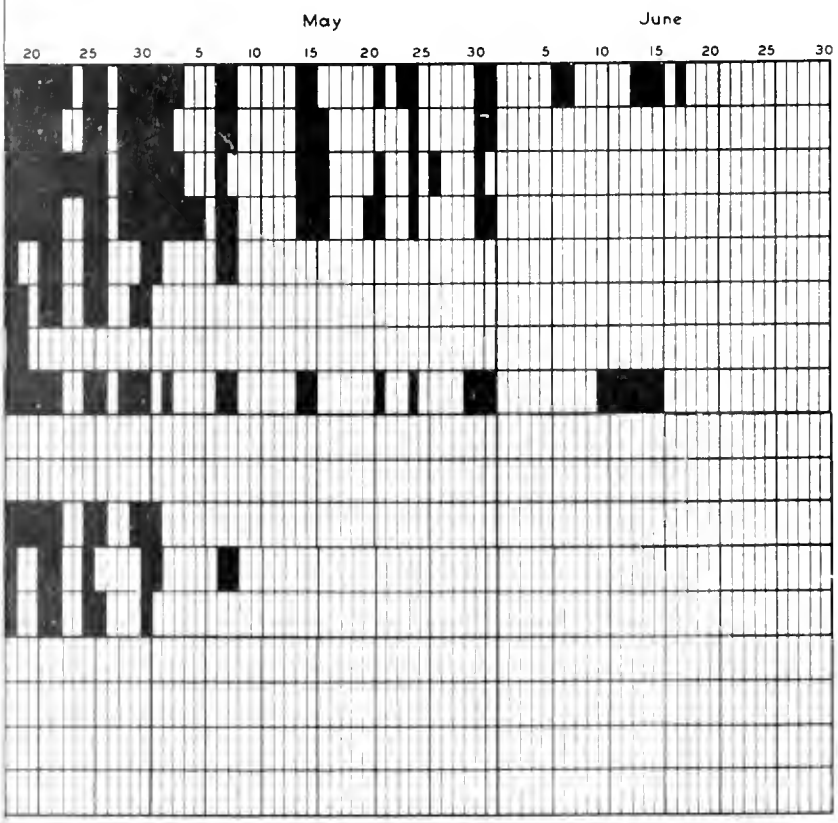




LOG OF WEATHER MODIFICATION OPERATIONS

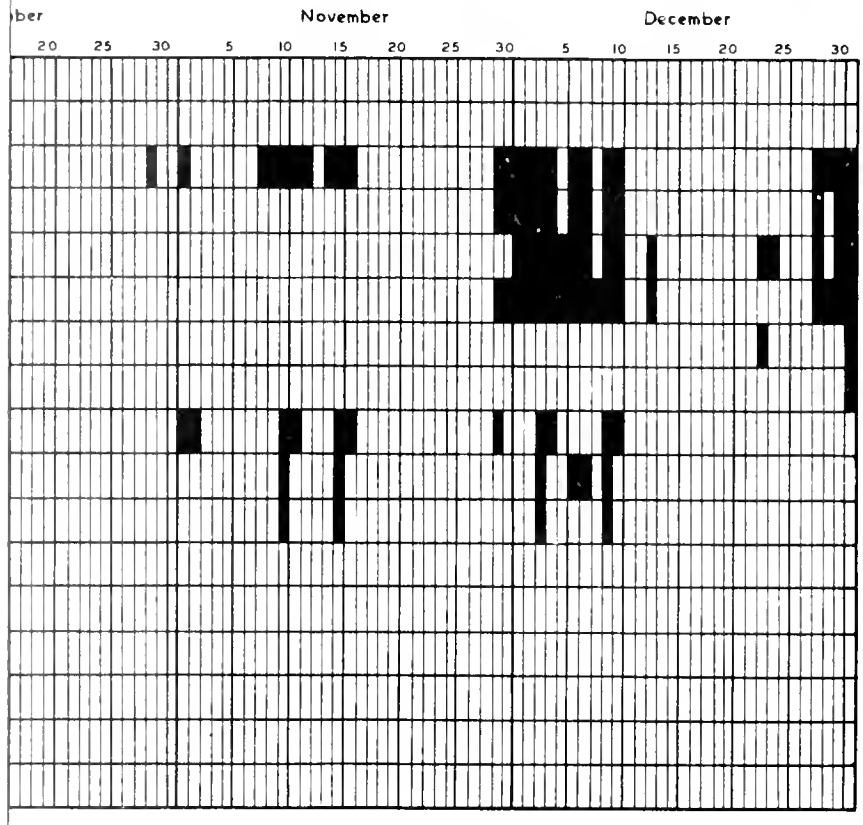
1953 - 54
SEASON

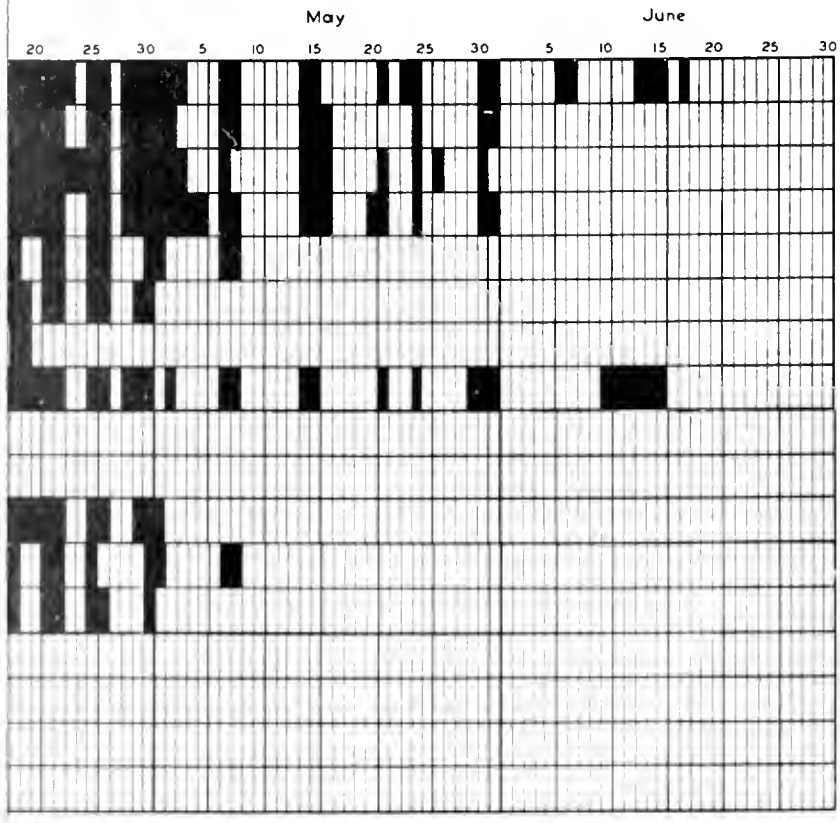




ERATIONS

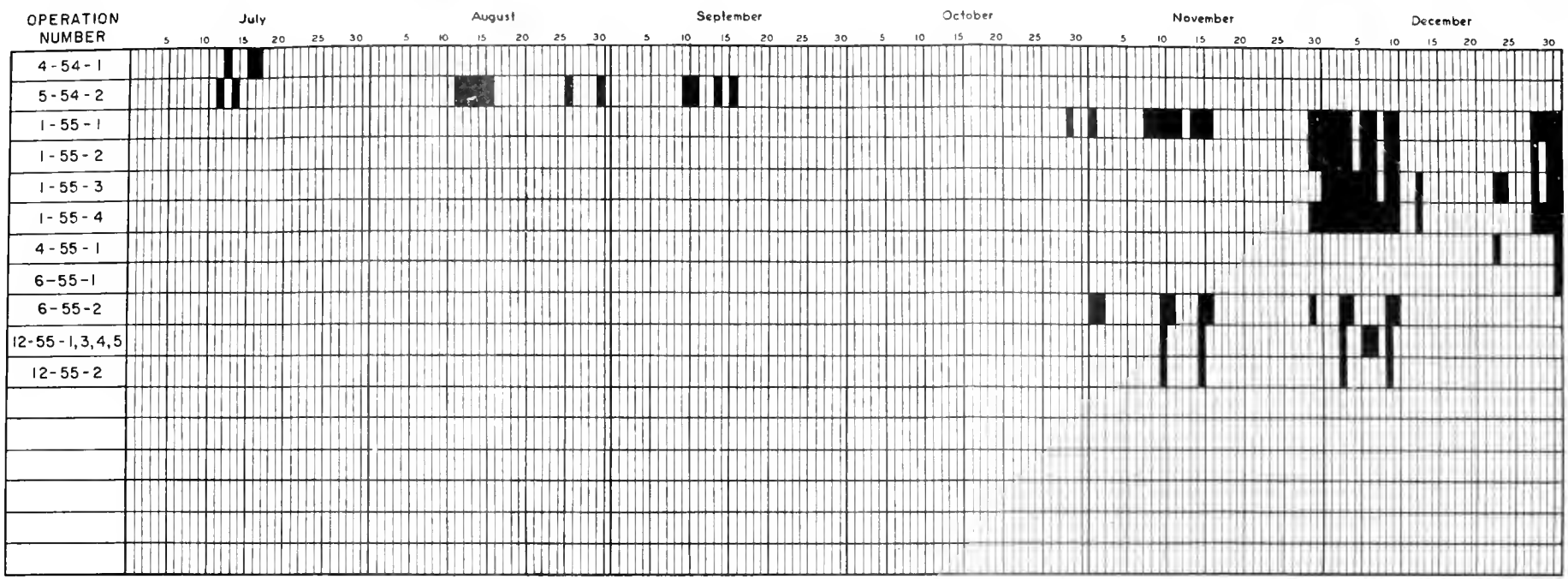
1954 - 55
SEASON

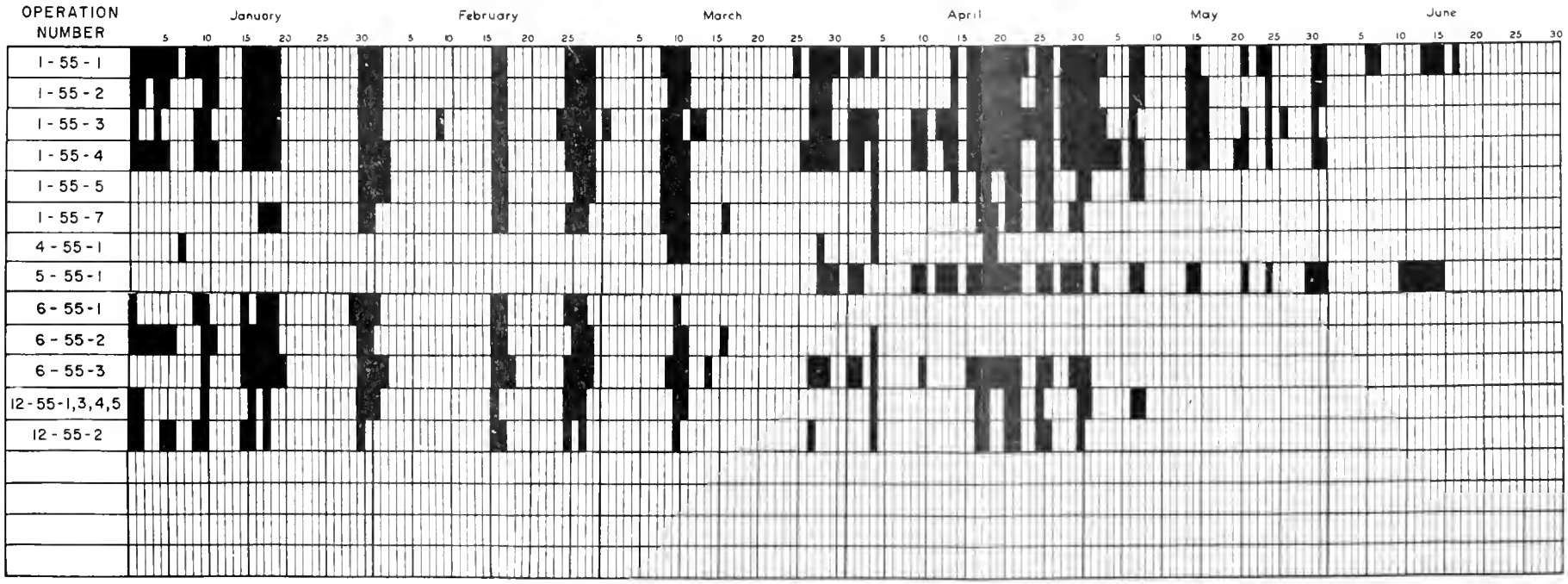




ERATIONS

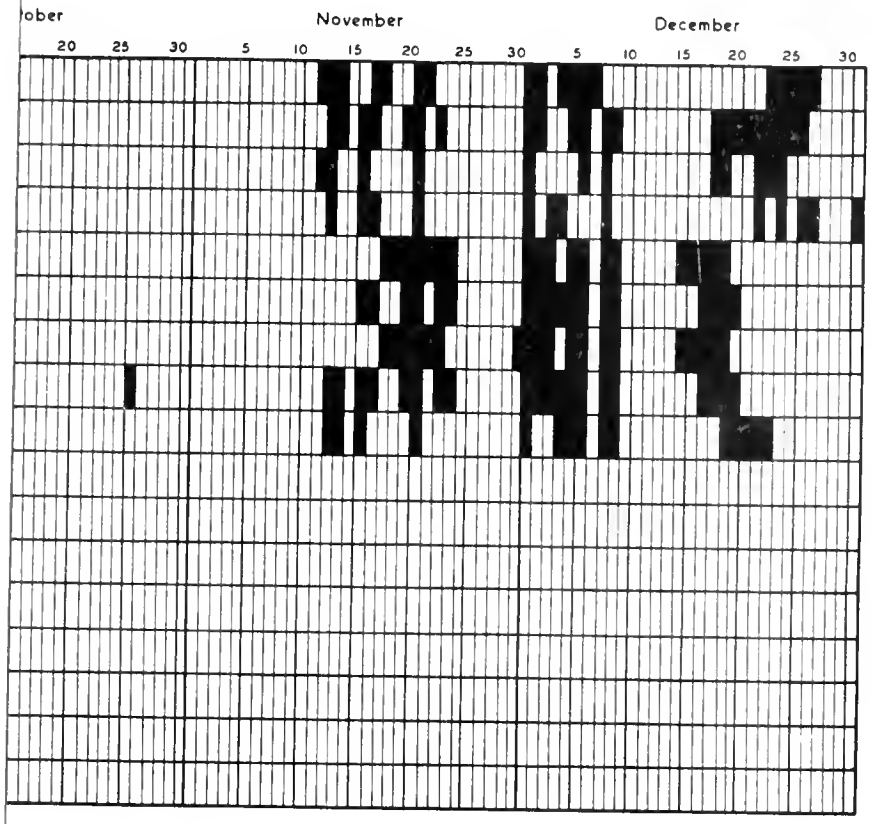
1954 - 55
SEASON

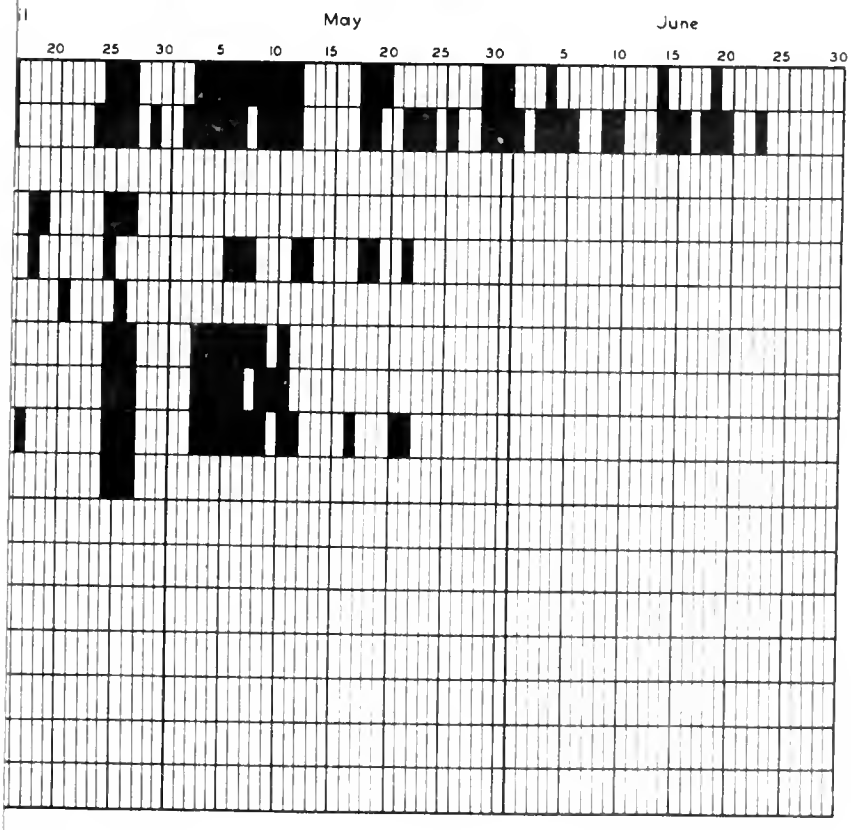




LOG OF WEATHER MODIFICATION OPERATIONS

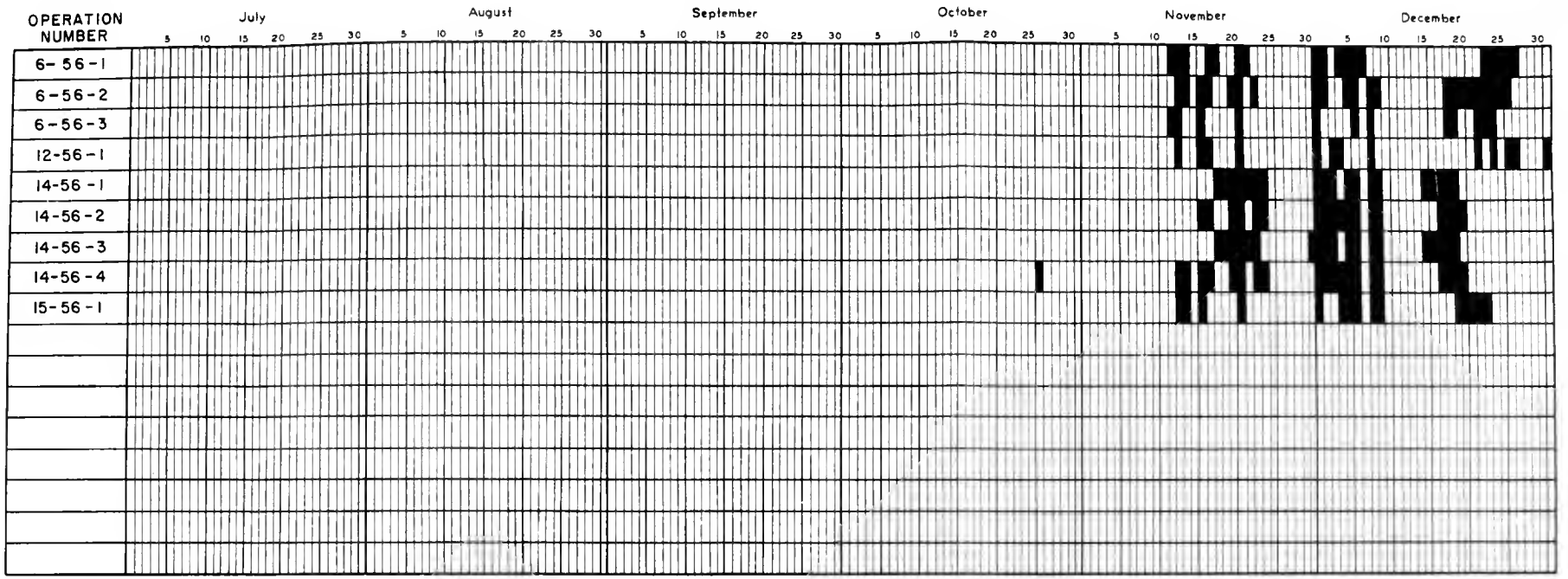
1954 - 55
SEASON

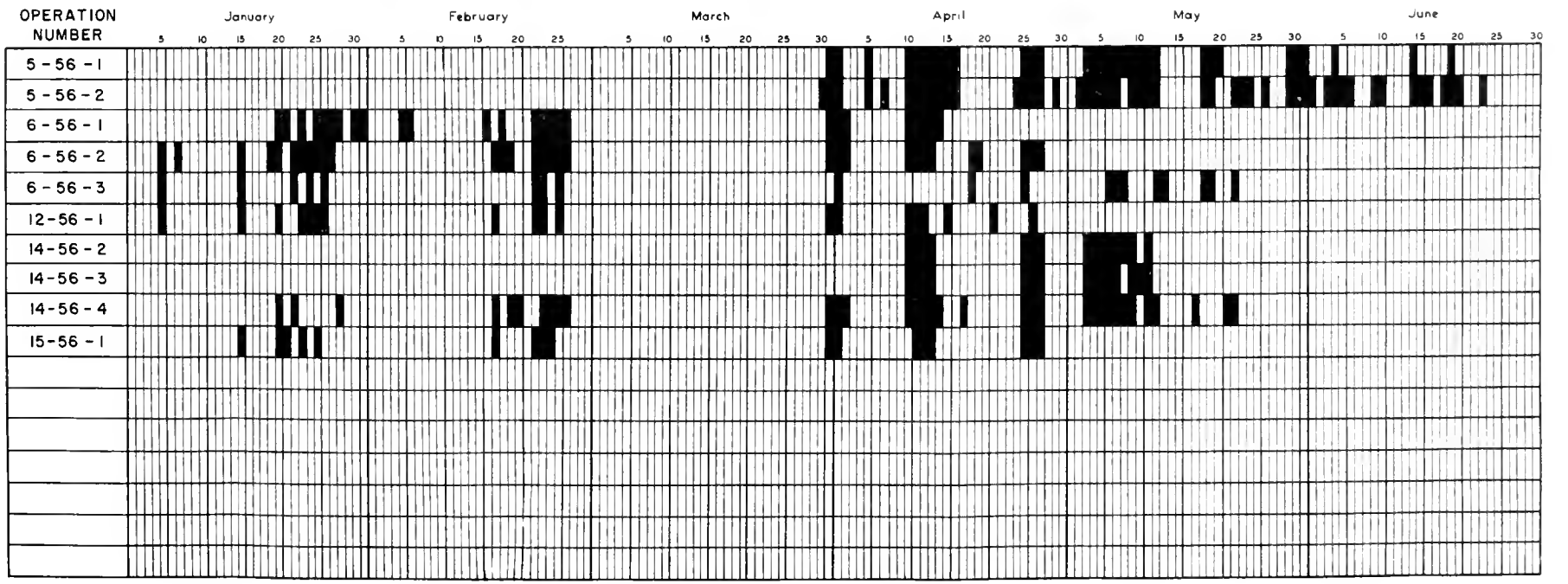




PERATIONS

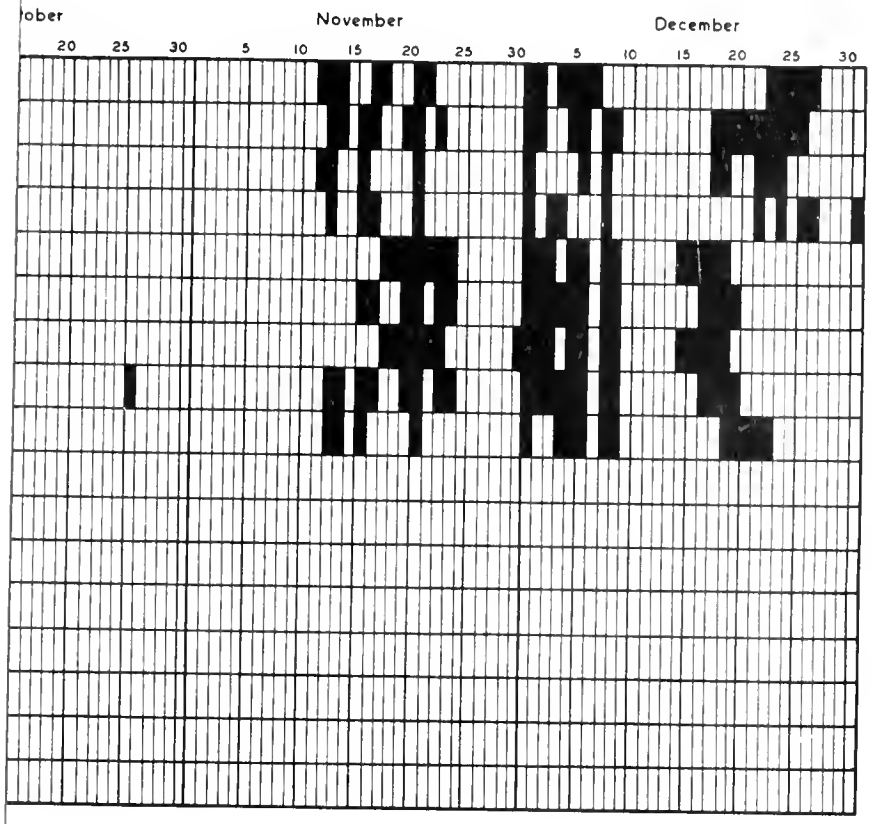
1955 – 56
SEASON

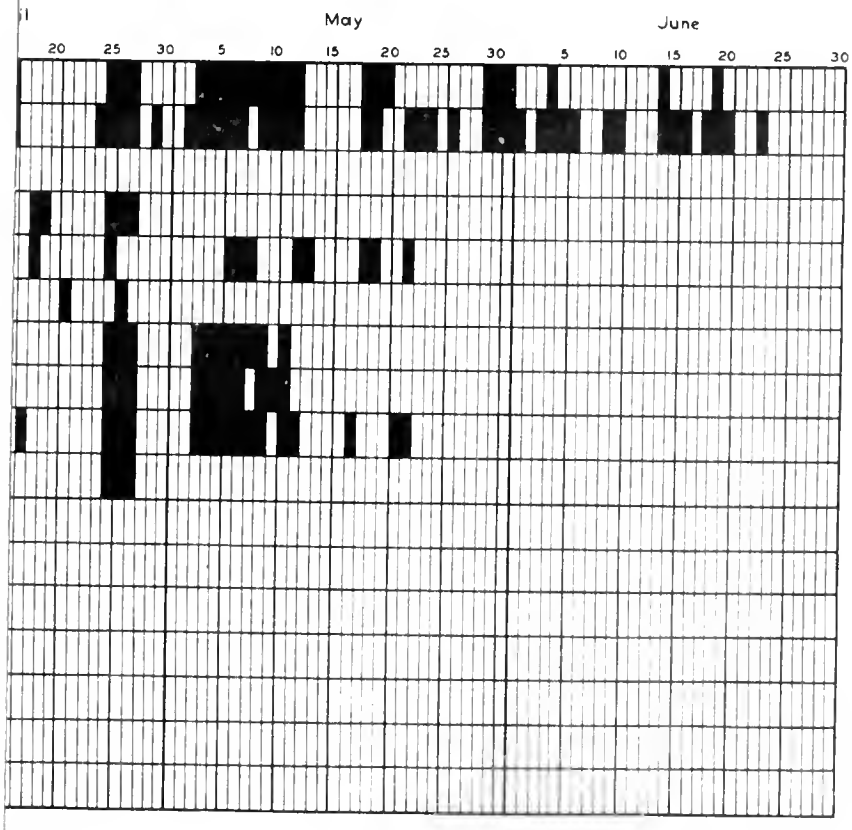




LOG OF WEATHER MODIFICATION OPERATIONS

1955-56
SEASON



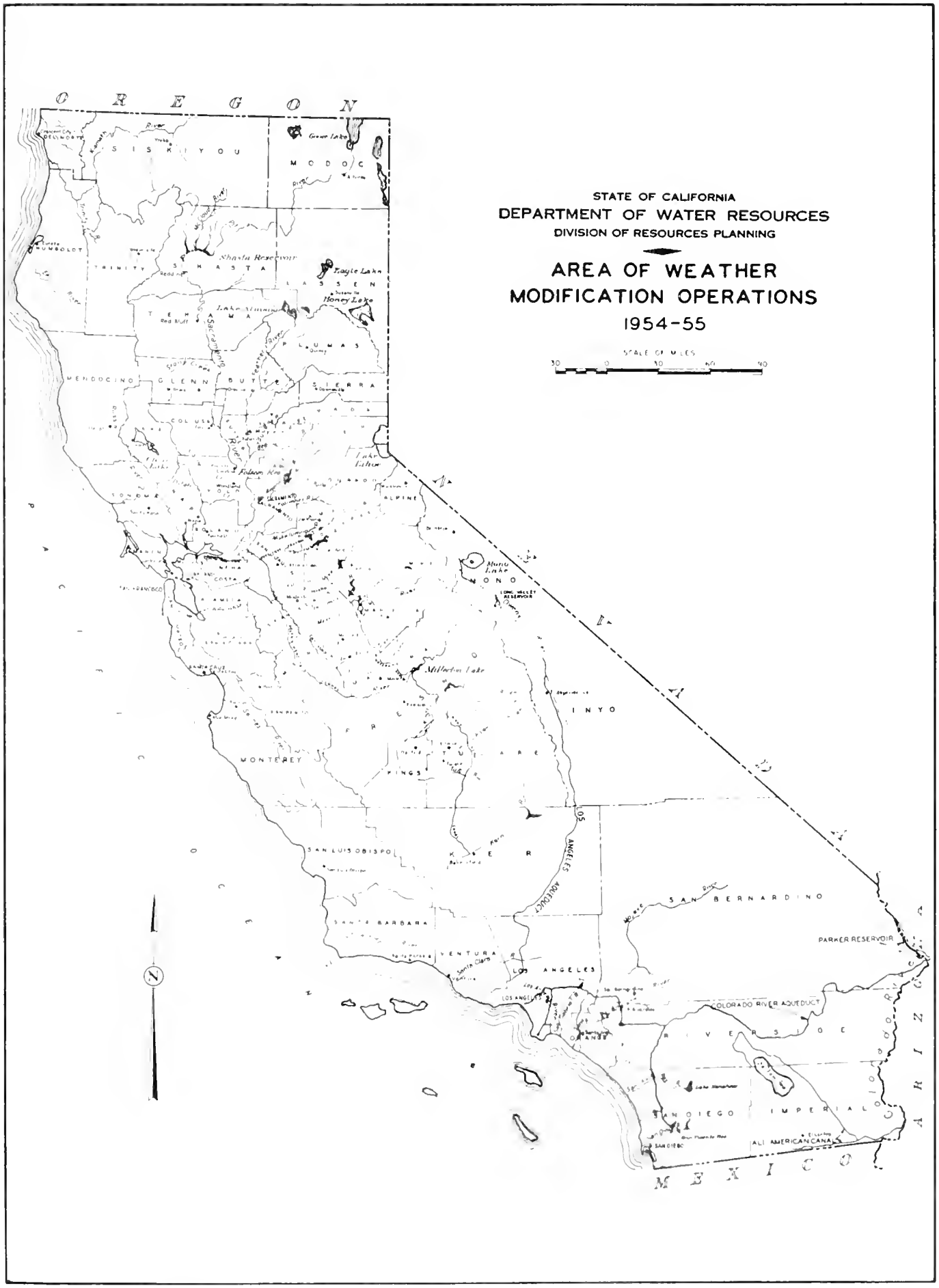


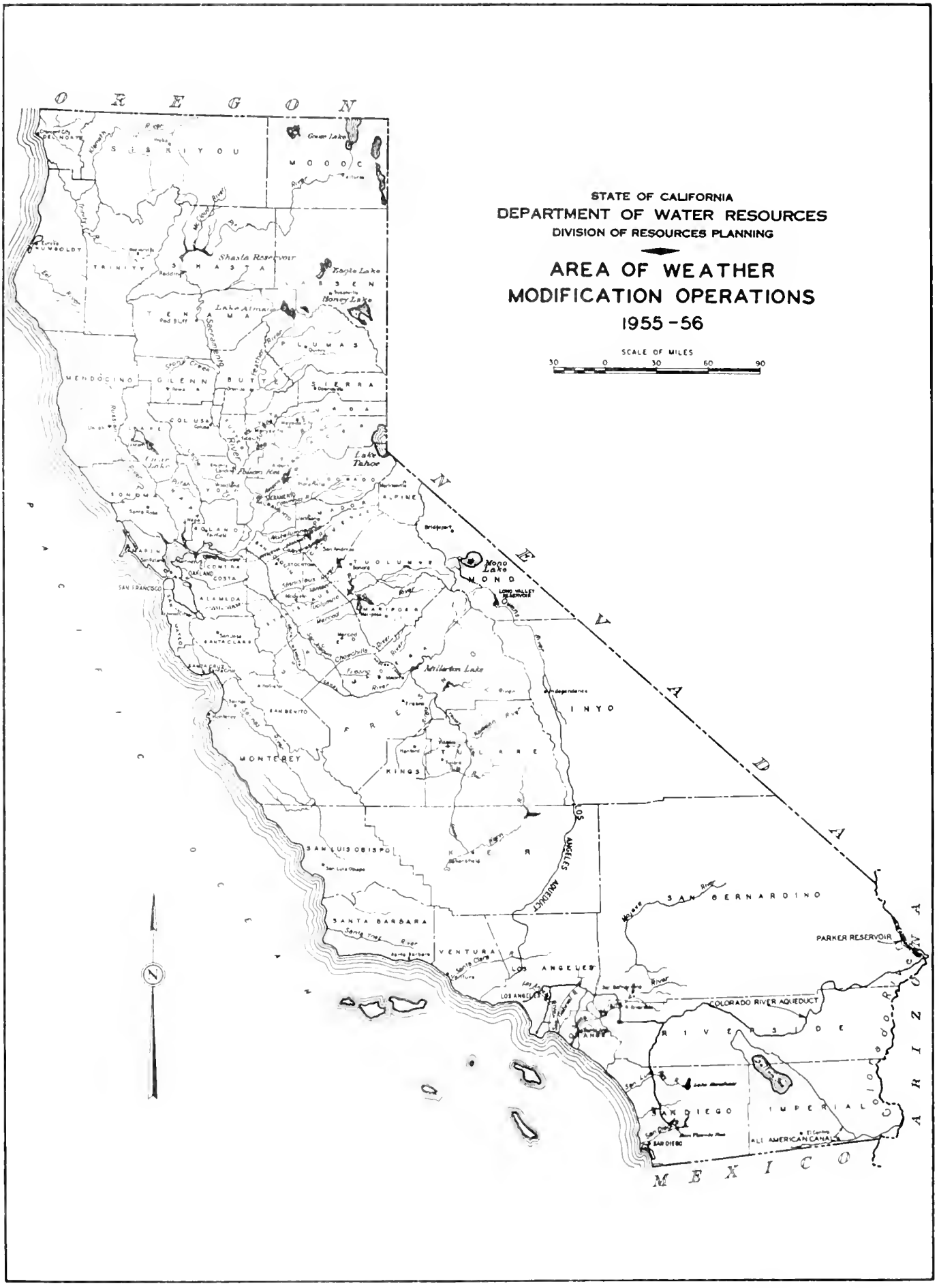
PERATIONS

1955 – 56
SEASON

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
AREA OF WEATHER
MODIFICATION OPERATIONS
1952-53
SCALE OF MILES
30 0 30 60 90
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
NEVADA
PLACER
LAKE
YOLO
SONOMA
SOLANO
ALPINE
MONO
CONTRA COSTA
ALAMEDA
SAN FRANCISCO
SANTA CLARA
MARIPOSA
TUOLUMNE
MONTEREY
FRESNO
INYO
TULARE
KINGS
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
Shasta Reservoir
Eagle Lake
Honey Lake
Lake Almanor
Lake Tahoe
Folsom Res
Mono Lake
Millerton Lake
LOS ANGELES AQUEDUCT
PARKER RESERVOIR
COLORADO RIVER AQUEDUCT
ALL AMERICAN CANAL
Colorado River

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
AREA OF WEATHER
MODIFICATION OPERATIONS
1953-54
SCALE OF MILES
30 0 30 60 90
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
LAKE
SONOMA
YOLO
SACRAMENTO
ALPINE
MARIN
CONTRA COSTA
ALAMEDA
SAN FRANCISCO
SANTA CLARA
SAN BENITO
MONTEREY
TUOLUMNE
MONO
MARIPOSA
INYO
PRESNO
TULARE
KINGS
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
Shasta Reservoir
Eagle Lake
Honey Lake
Lake Almanor
Clear Lake
Lake Tahoe
Mono Lake
Millerton Lake
LOS ANGELES AQUEDUCT
PARKER RESERVOIR
COLORADO RIVER AQUEDUCT
ALL AMERICAN CANAL
Colorado River
N


STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
AREA OF WEATHER
MODIFICATION OPERATIONS
1954-55
SCALE OF MILES
30 0 30 60 90
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
SONOMA
ALPINE
MONO
INYO
MONTEREY
KINGS
TULARE
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
Shasta Reservoir
Eagle Lake
Honey Lake
Lake Almanor
Folsom Res
Lake Tahoe
Mono Lake
Millerton Lake
LONG VALLEY RESERVOIR
LOS ANGELES AQUEDUCT
PARKER RESERVOIR
COLORADO RIVER AQUEDUCT
ALL AMERICAN CANAL
Colorado River
Sacramento River
Santa Clara
SAN FRANCISCO
SAN DIEGO
N


STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
AREA OF WEATHER
MODIFICATION OPERATIONS
1955 - 56
SCALE OF MILES
30 0 30 60 90
OREGON
NEVADA
ARIZONA
MEXICO
PACIFIC OCEAN
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
LAKE
SONOMA
YOLO
SACRAMENTO
ALPINE
MARIN
CONTRA COSTA
ALAMEDA
SAN FRANCISCO
SANTA CLARA
SANTA CRUZ
SAN BENITO
MONTEREY
KINGS
TULARE
INYO
MONO
TUOLUMNE
MARIPOSA
FRESNO
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
Shasta Reservoir
Eagle Lake
Honey Lake
Lake Almanor
Lake Tahoe
Mono Lake
Millerton Lake
LOS ANGELES AQUEDUCT
COLORADO RIVER AQUEDUCT
PARKER RESERVOIR
ALL AMERICAN CANAL
SAN DIEGO

A P P E N D I X A

CHAPTER 4, DIVISION 1 OF THE WATER CODE

CHAPTER 4, DIVISION 1 OF THE WATER CODE, STATE OF CALIFORNIA

REGULATION OF RAIN-MAKING AND RAIN-PREVENTION

(Chapter 4 added by Stats. 1953, Ch. 139, as part of codification)

400. The public interest, health, safety, welfare, and necessity require that scientific experimentation in the field of artificial nucleation, and that scientific efforts to develop, increase, and regulate natural precipitation be encouraged, and that means be provided for the regulation and control of interference by artificial means with natural precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, within the State, in order to develop, conserve, and protect the natural water resources of the State and to safeguard life and property.

401. As used in this chapter:

(a) "Department"* means the Department of Public Works acting through the State Engineer.

(b) "Person" means any person, firm, association, organization, partnership, company, corporation, private or public, county, city, city and county, district, or other public agency.

402. No person, without first securing a license from the department, shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere.

403. Any person desiring to do any of the acts specified in Section 402 may file with the department an application in writing for a license. Each application shall be accompanied by a filing fee fixed by the department with the approval of the Department of Finance but not to exceed fifty dollars ($50) and shall be on a form to be supplied for such purpose by the department.

404. Every application shall set forth all of the following:

(a) The name and post-office address of the applicant.

(b) The previous education, experience, and qualifications of the applicant, or, if the applicant is other than an individual, the previous education, experience, and qualifications of the persons who will be in control of and charged with the operations of the applicant.

* Pursuant to provisions of Sec. 153, Chap. 52, Stats. first extra session, 1956, the Department of Water Resources ". . . succeeds to and is vested with all of the powers, duties, purposes, responsibilities, and jurisdiction in matters pertaining to water or dams vested in the Department and Director of Public Works, the Division of Water Resources of the Department of Public Works, the State Engineer . . . or any officer or employee thereof." This chapter became effective on July 5, 1956.

(c) A general description of the operations which the applicant intends to conduct and the method and type of equipment that the applicant proposes to use.

(d) Such other pertinent information as the department may require.

405. Upon the filing of the application upon a form supplied by the department and containing the information prescribed by this chapter and accompanied by the required filing fee the department shall issue a license to the applicant entitling the applicant to conduct the operations described in the application for the calendar year for which the license is issued, unless the license is sooner revoked or suspended.

406. A license may be renewed annually upon application to the department, accompanied by a renewal fee fixed by the department with the approval of the Department of Finance but not to exceed twenty-five dollars ($25), on or before the last day of January of the calendar year for which the license is renewed.

407. Prior to undertaking any operation authorized by the license the licensee shall file with the department and cause to be published a notice of intention. The licensee shall then confine his activities for that operation substantially within the time and area limits set forth in the notice of intention.

408. The notice of intention shall set forth all of the following:

(a) The name and address of the licensee.

(b) The nature and object of the intended operation and the person or persons on whose behalf it is to be conducted.

(c) The area in which and the approximate time during which the operation will be conducted.

(d) The area which will be affected by the operation as near as the same may be determined in advance.

409. The licensee shall cause the notice of intention to be published at least once a week for three consecutive weeks in a newspaper having a general circulation and published within any county wherein the operation is to be conducted and in which the affected area is located, or, if the operation is to be conducted in more than one county or if the affected area is located in more than one county or is located in a county other than the one in which the operation is to be conducted, then such notice shall be caused to be published in like manner in a newspaper having a general circulation and published within each of such counties. In case there is no newspaper published within the appropriate county, publication shall be made in a newspaper having a general circulation within the county.
(Amended by Stats. 1955, Ch. 482)

410. Proof of publication shall be filed by the licensee with the department within 15 days from the date of the last publication of the notice. Proof of publication shall be by copy of the notice as published attached to and made a part of the affidavit of the publisher or foreman of the newspaper publishing the notice.

411. Every licensee shall keep and maintain a record of all operations conducted by him pursuant to his license showing the method employed, the type of equipment used, the times and places of operation of the equipment, the name and post-office address of each person participating or assisting in the operation other than the licensee, and such other information as may be required by the department, and shall report the same to the department immediately upon the completion of each operation.

412. Each licensee shall further prepare and maintain an evaluation statement for each operation which shall include a report as to estimated precipitation, defining the gain or loss occurring from nucleation activities, together with supporting data therefor. This statement, together with such other pertinent information as the department may require, shall be sent to the department upon request by the department.

413. Notwithstanding any provision of this chapter to the contrary, the department may grant a licensee permission to undertake an emergency nucleation project, without compliance by the licensee with the provisions of Sections 407 to 410, inclusive, if the same appears to the department to be necessary or desirable in aid of extinguishment of fires.

413.5 Notwithstanding any provision of this chapter to the contrary, upon request of the board of supervisors of a county or of the governing body of a city or a public district of the State, and upon the submission of such supporting evidence as the department may require, the department may grant a licensee permission to undertake a nucleation project for the purpose of alleviating a drought emergency, without prior compliance by the licensee with the provisions of Section 407 requiring publication of notice of intention, if such project appears to the department to be necessary or desirable. Nothing contained in this section shall be construed as to relieve the licensee in such case from compliance with the provisions of Sections 407 to 410, inclusive, requiring publication of notice of intention and filing of proof of such publication, as soon after the granting of permission by the department as is practicable.
(Added by Stats. 1955, Ch. 1399.)

414. Any license may be revoked or suspended if the department finds, after due notice to the licensee and a hearing thereon, that the licensee has failed or refused to comply with any of the provisions of this chapter. The proceedings herein referred to shall be conducted in accordance with the provisions of the Administrative Procedure Act, Chapter 5, Part 1, Division 3, Title 2 of the Government Code and the department shall have all the powers granted therein.

415. Any person who violates any provision of this chapter is guilty of a misdemeanor.

APPENDIX B

ADMINISTRATIVE FORMS

CONTENTS

Form number	Title
265	Application for License to Engage in Operations to Modify Natural Precipitation by Artificial Means
273	Completion Report by Licensee
274	Weather Modification Evaluation Statement

FILE IN DUPLICATE

(For full information concerning the filling out of this form refer to instructions)

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
P. O. BOX 1079
SACRAMENTO, CALIFORNIA

Application No. - - - - - - - - - Filed - - - - - - - - - - - - at - - - - - - - - M.
(Applicant - do not write in above space)

APPLICATION FOR LICENSE TO ENGAGE IN OPERATIONS TO MODIFY NATURAL PRECIPITATION BY ARTIFICIAL MEANS

1. Name of Applicant _____
(person as defined in statute)

2. Business Address _____

3. Applicant intends to do business as a _____
(individual, copartnership, corporation, other)

4. Print below the full name, title and address of the personnel of applicant, including the person or persons who will be in control of and charged with operations of applicant.

Personnel of Applicant Full Name (Do not use initials)	Title or Position (Owner, copartner, officer, responsible managing employee)	Residence Address

5. Has any person listed in the "Personnel of Applicant" been convicted of a felony in this State or elsewhere? ____ If so attach a detailed statement.

---

6. Has any person listed in the "Personnel of Applicant" been denied a license of any kind, or had a license suspended or revoked? _____ If so, attach a detailed statement. _____

---

7. Give the name, education, experience and qualifications of person or persons who will be in control of and charged with operations of applicant. (If more than one attach additional sheets)

NAME _____

EDUCATION

Grammar School (Circle last year completed) 1 2 3 4 5 6 7 8			
Name of School	Course of Study	Year	Graduate (Yes or No) year of Graduation
High School		9 10 11 12	
Jr. College	Major	1 2 3	
College or University		1 2 3 4	Degree
University Graduate Study		Hrs. or Units	Degree
Certificates of Professional or Vocational Competence or License			
Membership in Professional or Technical Associations			

EXPERIENCE (Please begin with most recent experience)

From Mo.	From Yr.	To Mo.	To Yr.	Occupations and Description of Duties (List each position separately)	Employers (Names, Addresses and types of business)

Special educational and experience qualifications which you believe this person possesses.

8. Give general description and purpose of operations in which you intend to engage.

9. Give type of equipment and nucleating agent to be used in your operations:

Dated this _____ day of _____ 19 ___.

By _____
(If other than applicant state by what authority deponent represents applicant)

Subscribed and sworn to before me
this _____ day of _____, 19 __.

_____
Notary Public in and for the County
of _____, State of California.

Form 265

Forward completed report
in duplicate to
Harvey O. Banks
Director of Water Resources
P. O. Box 1079
Sacramento 5, California

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
P. O. Box 1079
Sacramento 5, California

COMPLETION REPORT BY LICENSEE

Weather Modification Operation
Chapter 4, Division 1 of the Water Code

1. _____, _____
Name of Licensee — License Number

_____
Post-office Address

2. _____, _____
Name of Client — Address

3. Period covered by report _____

4. Location of operation _____

5. Date of "Notice of Intention" _____

6. Cloud seeding technique employed _____

_____

7. Type of Equipment used _____

_____

8. Persons who assisted or participated in the operation:

Name	Post-office Address
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Completion Report By Licensee (Cont'd)

9. Operation of equipment:

Generator location _____

Flight course _____

Date	Time on	Time off	Total time	Rate of use of agent	Weather Conditions

Total operating time _____ Hours from _____ Date to _____ Date (inclusive).

Date _____ Signed _____

Form 273

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

FORWARD IN DUPLICATE TO
H. O. BANKS
DIRECTOR
P. O. BOX 1079
SACRAMENTO 5

WEATHER MODIFICATION EVALUATION STATEMENT

(Chapter 4, Division 1 of Water Code)

Licensee..... Date of Notice of Intention.....
License Number..... Period of Evaluation.....
Client..... Evaluation Report No.....
Location of operation.....

	PRECIPITATION STATIONS	LONG TIME SEASONAL NORMAL (PERIOD)	PRECIPITATION DURING EVALUATION PERIOD	% OF SEASONAL NORMAL DURING EVALUATION PERIOD (COLUMN 3 / COLUMN 2 x 100)	AVERAGE % OF SEASONAL NORMAL DURING EVALUATION PERIOD (COLUMN 4) / (No. OF STA.)	% OF RAINFALL ON TARGET AREA COMPARED WITH CONTROL AREA
	1	2	3	4	5	6
TARGET AREA						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
No. of Stations →			Total →			
CONTROL AREA						
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
No. of Stations →			Total →			

FORM 274

PHYSICAL SCI. LIB.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

REPORT ON

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

JULY, 1956 - JUNE, 1957

GOODWIN J. KNIGHT
Governor

HARVEY O. BANKS
Director of
Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

REPORT ON

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

JULY, 1956 - JUNE, 1957

GOODWIN J. KNIGHT
Governor

HARVEY O. BANKS
Director of
Water Resources

ARVEY O. BANKS
DIRECTOR

GOODWIN J. KNIGHT
GOVERNOR

ADDRESS REPLY TO
P. O. BOX 388 SACRAMENTO 2
1120 N STREET HICKORY 5-4711

STATE OF CALIFORNIA

Department of Water Resources

SACRAMENTO

July 21, 1958

Honorable Goodwin J. Knight, Governor,
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources entitled, "Weather Modification Operations in California, July, 1956-June, 1957."

During the period covered by the report, there were 18 projects involving weather modification operations which were undertaken in California. These projects were accomplished by 11 operators who were licensed by the Department for such activities.

Very truly yours,

Harvey O. Banks

HARVEY O. BANKS
Director

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2	WEATHER MODIFICATION OPERATIONS JULY 1, 1956 - JUNE 30, 1957	5

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WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

July, 1956, through June, 1957

INTRODUCTION

In July, 1951, the State Legislature enacted Chapter 1677, Statutes of 1951, for the regulation and licensing of weather modification in the State of California. This Act, which was codified in 1953 as Chapter 4, Division 1 of the Water Code, provides that:

> "No person, without first securing a license from the department shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere."

In addition, licensees are required by law to submit a completion report to the Department at the conclusion of each weather modification project conducted by them. The completion reports include records of all operations, type of equipment used, time and place of operation of the equipment and such other information as may be required by the Department. This summary on weather modification activities in California has been prepared from the completion reports submitted by licensees and from other available data.

Statutory provisions pertinent to artificial weather modification operations are included herein as Appendix A.

This report on weather modification operations includes records of operation throughout the State for the period July, 1956, through June, 1957. A complete record of weather modification operations since 1951 is available in the files of the Department. A summary of operations conducted from July, 1952, through June, 1956, was embodied in a report "Weather Modification Operations in California," which was prepared in January, 1957, and given

limited distribution. Data on operations prior to 1952 and the evaluations of former cloud seeding studies and experiments were published in State Water Resources Bulletin No. 16, "Weather Modification Operations in California," June, 1955.

SUMMARY OF OPERATIONS

During the period covered by this report, weather modification operations were conducted throughout the State from Siskiyou and Del Norte Counties in the north to San Diego and Riverside Counties in the south. A major part of the activity was concentrated along the western slope of the Sierra Nevada for the purpose of increasing precipitation on watersheds above hydroelectric installations. Other cloud seeding activities in mountainous regions were designed to dissipate lightning and reduce the incidence of forest fires. In principal agricultural areas and in the south coastal region, weather modification projects were placed in operation to suppress hail or increase precipitation.

Cloud seeding operations conducted during the period covered by this report included 13 projects for increasing precipitation, three projects for suppressing hail and one project designed to diminish lightning over the wooded areas of northern California. It is estimated that a total of 40,700 generator-hours were utilized in releasing 471,000 grams, or 1,040 pounds, of silver iodide in 153 days.

These 17 operations were conducted by seven different concerns holding licenses to conduct such operations. Table 1 lists all licenses which were in force during the period covered by this report.

Weather modification projects in California conducted during the period from July, 1956, through June, 1957, are listed in Table 2. Each project is designated by a compound number consisting of three components.

The first element is the license number, the second indicates the fiscal year of operation, and the third is assigned in numerical sequence to projects undertaken by a licensee during a precipitation year as shown by notices of intention filed with the Department. A daily log of cloud seeding is presented on Plate 1 and the approximate areas affected are delineated on Plate 2.

TABLE 1

WEATHER MODIFICATION CONCERNS THAT WERE LICENSED TO OPERATE DURING THE PERIOD FROM JULY, 1956, THROUGH JUNE, 1957

License Number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport, Goleta, California
4	California Electric Power Company P. O. Box 512, Riverside, California
5	Water Resources Development Corporation 460 South Broadway, Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport, San Jose, California
11	Kenneth R. Perry 250 Del Medio Avenue, Palo Alto, California
12	Precipitation Control Company of California 105 Pierce Street, Taft, California
13*	Nofog Corporation* 210 - 35th Street, Richmond, California
14	North American Weather Consultants Santa Barbara Municipal Airport, Goleta, California
15	Walter Floyd Jones 1704 Dixie Drive, Porterville, California
16	O.X. Cattle Corporation P. O. Box 585, El Centro, California
17	Department of Natural Resources, Division of Forestry State Office Building No. 1, Sacramento, California

* License expired December 31, 1956.

TABLE 2

WEATHER MODIFICATION OPERATIONS
July 1, 1956 - June 30, 1957

Operation number	Licensee	Client	Target area	Period of operation	Rate of use of nucleating agent in grams per hour*	Total generator hours		Purpose
						Ground	Air	
5-57-1	Water Resources Development Corporation	Santa Ana River Weather Corporation	Parts of Riverside, Orange, San Bernardino, Los Angeles Counties	Dec. 6, 1956 May 14, 1957	2.7	2061		Precipitation increase
5-57-2		Placer County Farm Labor Coop., Inc.	Parts of Placer, Nevada, and El Dorado Counties	Mar. 28, 1957 June 14, 1957	22.7	8896		Hail suppression
5-57-3		Medford Pear Shippers Association - Oregon	Parts of Siskiyou and Del Norte Counties (1)	Apr. 12, 1957 June 19, 1957	22.7	1060		Hail suppression
5-56-2		Medford Pear Shippers Association - Oregon	Parts of Siskiyou and Del Norte Counties (1)	July 12, 1956 Oct. 10, 1956	22.7	503		Hail suppression
6-57-1	Weather Modification Company	California Electric Power Company	Bishop Creek Watershed, Inyo County	Oct. 30, 1956 Mar. 29, 1957	13.6		38	Precipitation increase
6-57-2		Kings River Conservation District	Parts of Fresno, Tulare and Inyo Counties	Dec. 4, 1956 Apr. 20, 1957	13.6	1810	162	Precipitation increase
11-57-2	Kenneth R. Parry	Santa Clara County	Parts of Santa Clara County	Dec. 1, 1956 Apr. 15, 1957	Unknown	2700		Precipitation increase. Generator hrs. estimated
12-57-1	D. D. Merrill, dba, Precipitation Control Company of Calif.	Kern County Board of Supervisors and Land Owners	Northwest portions of Kern County	Jan. 1, 1957 Apr. 30, 1957	42.6		29	Precipitation increase
12-57-2		Kern County Board of Supervisors and Land Owners	East Portions of Kern and Tulare Counties	Jan. 1, 1957 Apr. 30, 1957	42.6		74	Precipitation increase
14-57-1	North American Weather Consultants	Southern California Edison Company	South Fork San Joaquin River Basin	Oct. 23, 1956 May 5, 1957	7.6	4074		Precipitation increase

TABLE 2 (Continued)

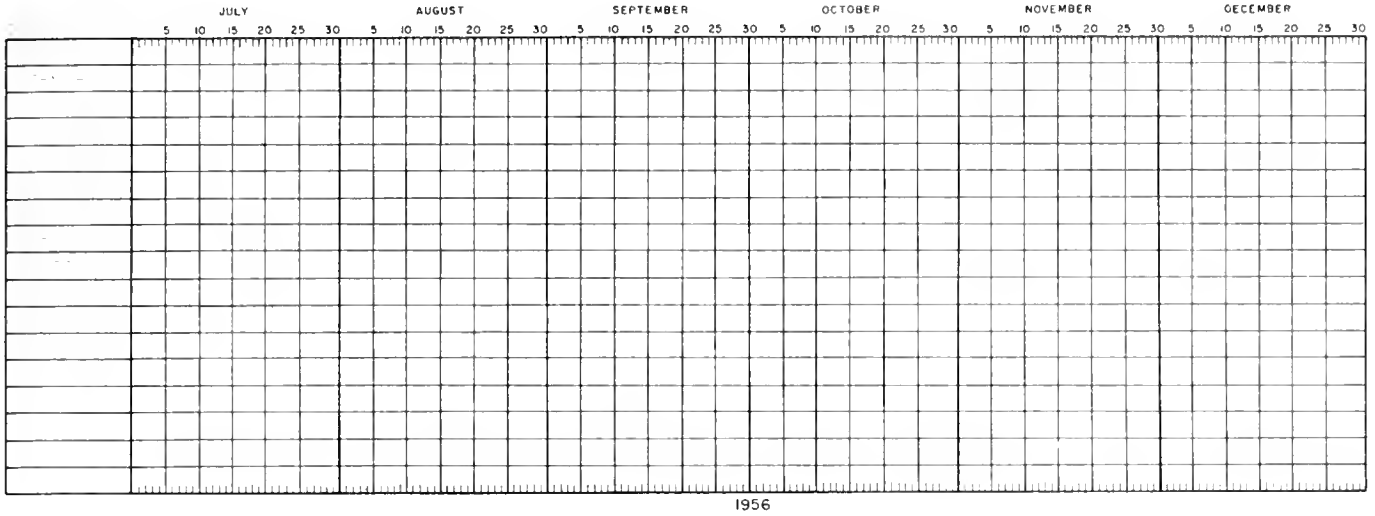
WEATHER MODIFICATION OPERATIONS
July 1, 1956 - June 30, 1957

Operation number	Licensee	Client	Target area	Period of operation	Rate of use of nucleating agent in grams per hour*	Total generator hours		Purpose
						Ground	Air	
14-57-2	North American Weather Consultants	Pacific Gas and Electric Company	Lake Almanor Basin, Plumas and Lassen Counties	Dec. 4, 1956 May 20, 1957	7.6	6812		Precipitation increase
14-57-3		Pacific Gas and Electric Company	Crane Valley, Madera County	Dec. 4, 1956 May 27, 1957	7.6	3286		Precipitation increase
14-57-4		Pacific Gas and Electric Company	Mokelumne and Stanislaus Watersheds	Dec. 4, 1956 May 20, 1957	7.6	6687		Precipitation increase
14-57-5		Santa Barbara County Water Agency	Santa Barbara County	Jan. 4, 1957 Apr. 18, 1957	7.6	1158		Precipitation increase
14-57-6		San Diego County Weather Corporation	San Diego County	Jan. 1, 1957 Apr. 22, 1957	7.6	2991		Precipitation increase
16-57-1	O.X. Cattle Company, Inc.	O.X. Cattle Company, Inc.	Lanfair Valley near Needles, California	July 11, 1956 Apr. 9, 1957	Unknown	963		Precipitation increase
17-57-1	Department of Natural Resources	Division of Forestry	Parts of Lassen, Shasta, and Siskiyou Counties	July 1, 1956 Sept. 20, 1956	60.0		49	Lightning suppression 22 minutes of seeding in June, 1956
17-58-1		Division of Forestry	Parts of Lassen, Shasta, Tehama, Butte, Plumas, and Modoc Counties	June 27, 1957 June 30, 1957	5.8	965		Lightning suppression

* Silver iodide was used on all projects.

(1) Target area was Rogue River Valley, Oregon, but some equipment was operated in California.

PLATE I



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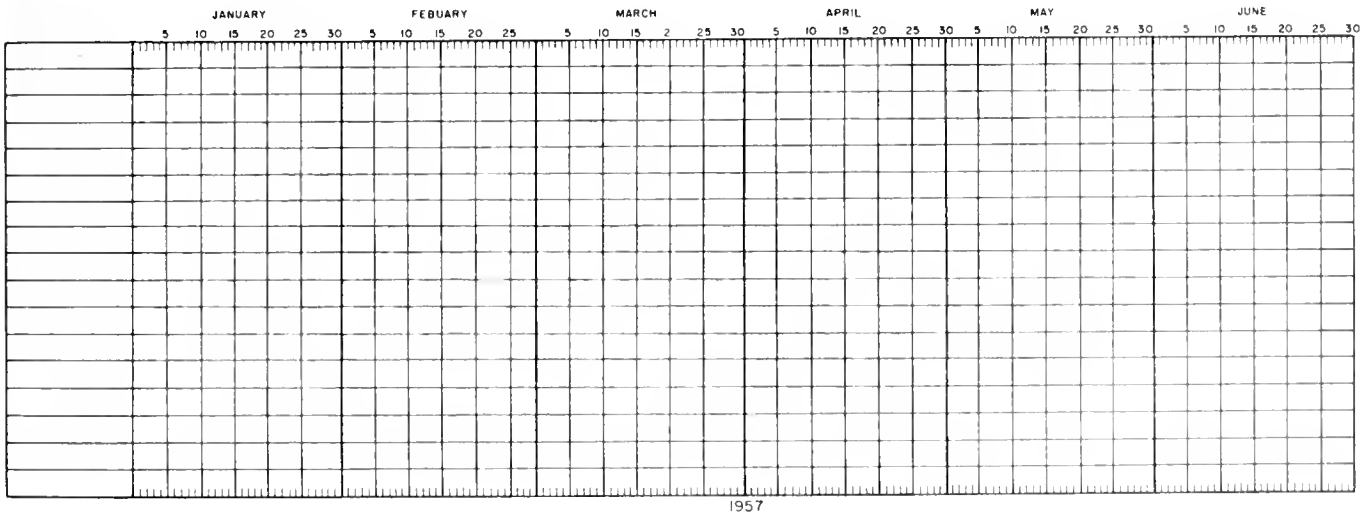
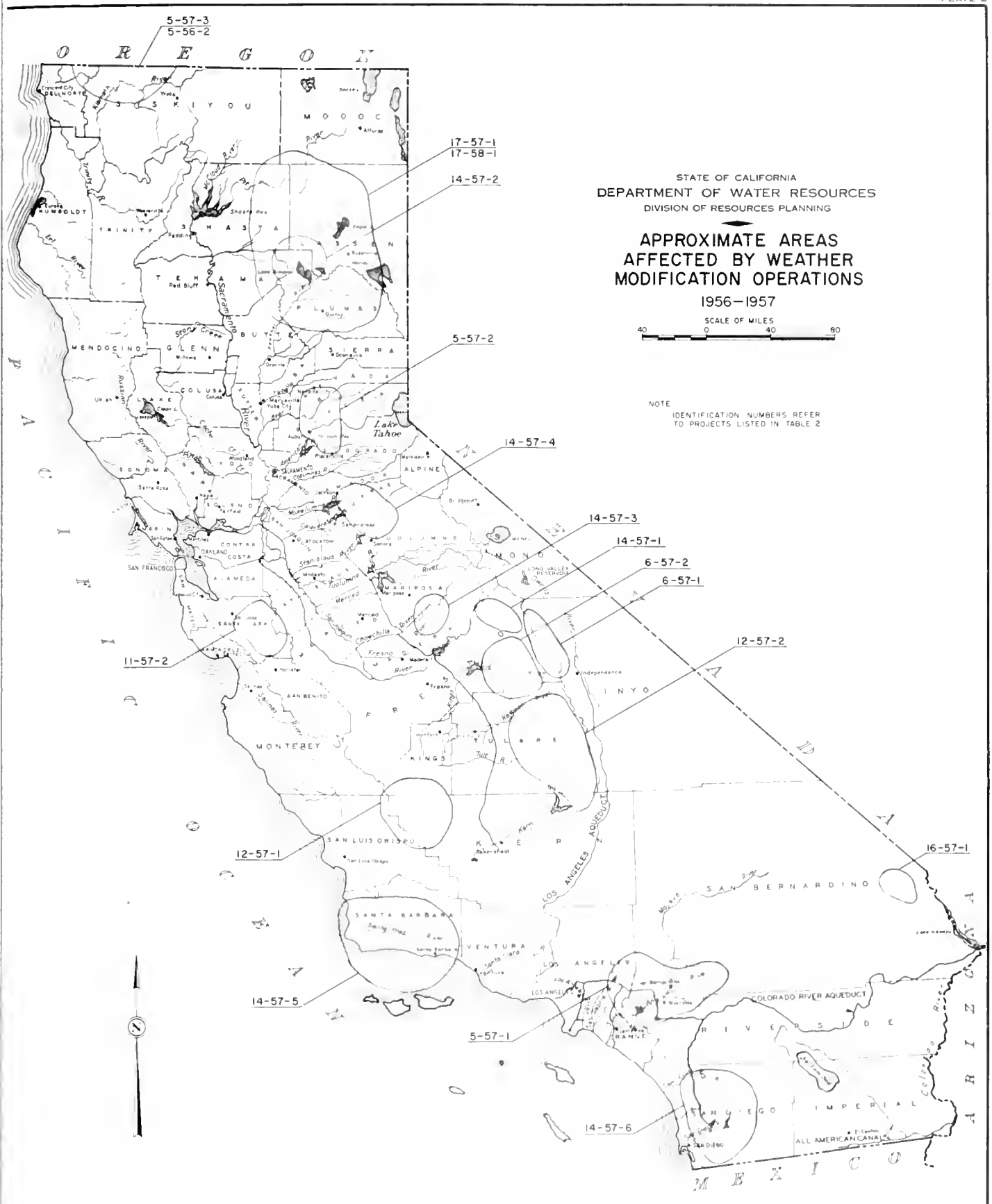


1957

LOG OF WEATHER MODIFICATION OPERATIONS

JULY 1956 THROUGH JUNE 1957

DEPARTMENT OF WATER RESOURCES 1958



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS

1956–1957

SCALE OF MILES
40 0 40 80

NOTE
IDENTIFICATION NUMBERS REFER TO PROJECTS LISTED IN TABLE 2

APPENDIX A

CHAPTER 4, DIVISION 1 OF THE WATER CODE

CHAPTER 4, DIVISION 1 OF THE WATER CODE, STATE OF CALIFORNIA

REGULATION OF RAIN-MAKING AND RAIN-PREVENTION

(Chapter 4 added by Stats. 1953, Ch. 139, as part of codification)

400. The public interest, health, safety, welfare, and necessity require that scientific experimentation in the field of artificial nucleation, and that scientific efforts to develop, increase, and regulate natural precipitation be encouraged, and that means be provided for the regulation and control of interference by artificial means with natural precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, within the State, in order to develop, conserve, and protect the natural water resources of the State and to safeguard life and property.

401. As used in this chapter:

(a) "Department"* means the Department of Public Works acting through the State Engineer.

(b) "Person" means any person, firm, association, organization, partnership, company, corporation, private or public, county, city, city and county, district, or other public agency.

402. No person, without first securing a license from the department, shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere.

403. Any person desiring to do any of the acts specified in Section 402 may file with the department an application in writing for a license. Each application shall be accompanied by a filing fee fixed by the department with the approval of the Department of Finance but not to exceed fifty dollars ($50) and shall be on a form to be supplied for such purpose by the department.

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(c) A general description of the operations which the applicant intends to conduct and the method and type of equipment that the applicant proposes to use.

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(c) The area in which and the approximate time during which the operation will be conducted.

(d) The area which will be affected by the operation as near as the same may be determined in advance.

409. The licensee shall cause the notice of intention to be published at least once a week for three consecutive weeks in a newspaper having a general circulation and published within any county wherein the operation is to be conducted and in which the affected area is located, or, if the operation is to be conducted in more than one county or if the affected area is located in more than one county or is located in a county other than the one in which the operation is to be conducted, then such notice shall be caused to be published in like manner in a newspaper having a general circulation and published within each of such counties. In case there is no newspaper published within the appropriate county, publication shall be made in a newspaper having a general circulation within the county.
(Amended by Stats. 1955, Ch. 482)

410. Proof of publication shall be filed by the licensee with the department within 15 days from the date of the last publication of the notice. Proof of publication shall be by copy of the notice as published attached to and made a part of the affidavit of the publisher or foreman of the newspaper publishing the notice.

411. Every licensee shall keep and maintain a record of all operations conducted by him pursuant to his license showing the method employed, the type of equipment used, the times and places of operation of the equipment, the name and post-office address of each person participating or assisting in the operation other than the licensee, and such other information as may be required by the department, and shall report the same to the department immediately upon the completion of each operation.

412. Each licensee shall further prepare and maintain an evaluation statement for each operation which shall include a report as to estimated precipitation, defining the gain or loss occurring from nucleation activities, together with supporting data therefor. This statement, together with such other pertinent information as the department may require, shall be sent to the department upon request by the department.

413. Notwithstanding any provision of this chapter to the contrary, the department may grant a licensee permission to undertake an emergency nucleation project, without compliance by the licensee with the provisions of Sections 407 to 410, inclusive, if the same appears to the department to be necessary or desirable in aid of extinguishment of fires.

413.5 Notwithstanding any provision of this chapter to the contrary, upon request of the board of supervisors of a county or of the governing body of a city or a public district of the State, and upon the submission of such supporting evidence as the department may require, the department may grant a licensee permission to undertake a nucleation project for the purpose of alleviating a drought emergency, without prior compliance by the licensee with the provisions of Section 407 requiring publication of notice of intention, if such project appears to the department to be necessary or desirable. Nothing contained in this section shall be construed as to relieve the licensee in such case from compliance with the provisions of Sections 407 to 410, inclusive, requiring publication of notice of intention and filing of proof of such publication, as soon after the granting of permission by the department as is practicable.
(added by Stats. 1955, Ch. 1399.)

414. Any license may be revoked or suspended if the department finds, after due notice to the licensee and a hearing thereon, that the licensee has failed or refused to comply with any of the provisions of this chapter. The proceedings herein referred to shall be conducted in accordance with the provisions of the Administrative Procedure Act, Chapter 5, Part 1, Division 3, Title 2 of the Government Code and the department shall have all the powers granted therein.

415. Any person who violates any provision of this chapter is guilty of a misdemeanor.

PHYSICAL SCI. LIB.

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DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

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SCIENCES
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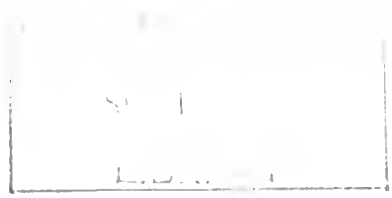
WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

AS REPORTED TO THE DEPARTMENT OF WATER RESOURCES

JULY, 1957 – SEPTEMBER, 1958



EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

AS REPORTED TO THE DEPARTMENT OF WATER RESOURCES

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AS REPORTED TO THE DEPARTMENT OF WATER RESOURCES

JULY, 1957 - SEPTEMBER, 1958

EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director of
Water Resources

HARVEY O. BANKS
DIRECTOR

EDMUND G. BROWN
GOVERNOR

ADDRESS REPLY TO
P. O. BOX 388 SACRAMENTO 2
1120 N STREET HICKORY 5-4711

STATE OF CALIFORNIA
Department of Water Resources
SACRAMENTO

July 20, 1959

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources entitled, "Weather Modification Operations in California, as reported to the Department of Water Resources, July, 1957 - September, 1958."

During the period covered by the report, there were 19 projects involving weather modification operations which were undertaken in California. These were accomplished by seven operators who were licensed by the Department for such activities.

Very truly yours,

HARVEY O. BANKS
Director

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SUMMARY OF OPERATIONS 2

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2 WEATHER MODIFICATION OPERATIONS JULY 1, 1957 - SEPTEMBER, 1958 5

PLATES

Plate Number

1 CALENDAR OF WEATHER MODIFICATION OPERATIONS JULY, 1957, THROUGH SEPTEMBER, 1958

2 APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS, 1957-1958

APPENDIX

A CHAPTER 4, DIVISION 1, OF THE WATER CODE 6

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

July, 1957, Through September, 1958

INTRODUCTION

In July, 1951, the State Legislature enacted Chapter 1677, Statutes of 1951, for the regulation and licensing of weather modification in the State of California. This Act, which was codified in 1953 as Chapter 4, Division 1, of the Water Code, provides that:

> "No person, without first securing a license from the department shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere."

In addition, licensees are required by law to submit a completion report to the Department at the conclusion of each weather modification project conducted by them. The completion reports include records of all operations, type of equipment used, time and place of operation of the equipment, and such other information as may be required by the Department. This summary on weather modification activities in California has been prepared from the completion reports submitted by licensees and from other available data.

Statutory provisions pertinent to artificial weather modification operations are included herein as Appendix A.

This report on weather modification operations includes records of operation throughout the State for the period July 1, 1957, through September 30, 1958. Formerly, the report embraced the period from July through June. The period covered in this report was adopted so as to avoid separation of cloud seeding schedules for operations that extended from June into September. Henceforth, the period to be covered by this report will be from October 1

through September 30 of the following year. This will permit the summer projects, designed mostly for lightning suppression, to be summarized in one report.

A complete record of weather modification operations since 1951 is available in the files of the Department. Summaries of previous operations have been published as follows:

Period of Operation	Publication
Jan., 1947 - June, 1952	State Water Resources Board Bulletin No. 16 - June, 1955
July, 1952 - June, 1956	"Weather Modification Operations in California" - January, 1957
July, 1956 - June, 1957	"Weather Modification Operations in California" - July, 1958

SUMMARY OF OPERATIONS

During the period covered by this report, weather modification operations were conducted throughout the State from Siskiyou and Del Norte Counties in the north to Riverside County in the south. A major part of the activity was concentrated along the western slope of the Sierra Nevada for the purpose of increasing precipitation on watersheds above hydroelectric installations. Other cloud seeding activities in mountainous regions were designed to dissipate lightning and reduce the incidence of forest fires. In principal agricultural areas and in the south coastal region, weather modification projects were placed in operation to suppress hail or increase precipitation.

Cloud seeding operations conducted during the period covered by this report included 13 projects for increasing precipitation, three projects for suppressing hail, and three projects designed to diminish lightning over the wooded areas of northern California. It is estimated that a total of 55,500 generator-hours were utilized in releasing 680,000 grams, or 1,970 pounds of

silver iodide in 727 total generator-days of cloud seeding during 234 calendar days between July 2, 1957, and September 25, 1958.

These 19 operations were conducted by seven of the eight concerns holding licenses to conduct such operations. Table 1 lists all licenses which were in force during the period covered by this report. The Department of Water Resources is not a cloud seeding agency.

Weather modification projects in California conducted during the period from July, 1957, through September, 1958, are listed in Table 2. Each project is designated by a compound number consisting of three components. The first element is the license number, the second indicates the fiscal year of operation, and the third is assigned in numerical sequence to projects undertaken by a licensee during a precipitation year, as shown by notices of intention filed with the Department. A daily log of cloud seeding is presented on Plate 1 and the approximate areas affected are delineated on Plate 2.

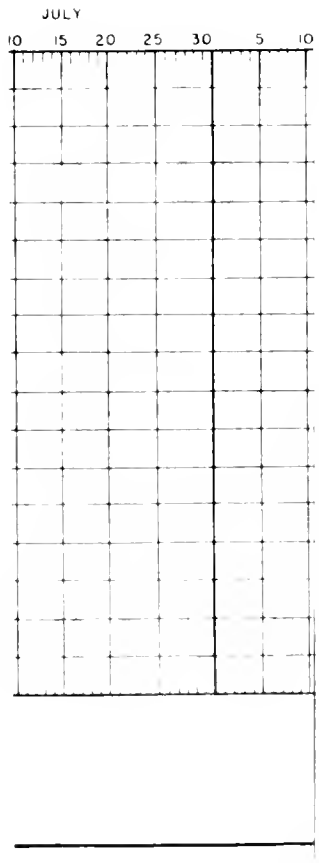
TABLE 1

WEATHER MODIFICATION CONCERNS THAT WERE LICENSED TO OPERATE DURING THE PERIOD FROM JULY, 1957, THROUGH SEPTEMBER, 1958

License Number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport, Goleta, California
4	California Electric Power Company P. O. Box 512, Riverside, California
5	Water Resources Development Corporation 460 South Broadway, Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport, San Jose, California
12	Precipitation Control Company of California 105 Pierce Street, Taft, California
14	North American Weather Consultants of California Santa Barbara Municipal Airport, Goleta, California
17	Department of Natural Resources, Division of Forestry State Office Building No. 1, Sacramento, California
18	Los Angeles County Flood Control District Box 2418, Terminal Annex, Los Angeles, California

Operation Number	Licensee	Client	Target Area	Period of Operation	Rate of Use of Silver Iodide in Grams Per Hour: Ground Base	Air-Borne	Mobile Gr. Base	Total Generator Hours: Ground	Air	Purpose
4-58-1 1/2/	California Electric Power Company	California Electric Power Company	Bishop Creek Area	Oct. 11, 1957 July 28, 1958		21.8			11	Precipitation increase
5-58-1	Water Resources Development Corporation	Santa Ana Weather Association, Inc.	Santa Ana Basin	Oct. 18, 1957 May 11, 1958	4.6 3/			3273		Precipitation increase
5-58-2		Placer County Farm Labor Coop., Inc.	Parts of Placer, Nevada, and El Dorado Counties	Mar. 3, 1958 June 13, 1958	22.7	135.0	90.0	8091	34	Hail suppression
5-58-3		Medford Pear Shippers' Association, Oregon	Parts of Siskiyou and Del Norte Counties	Mar. 20, 1958 Sept. 12, 1958	30.0			2477		Hail suppression
5-58-4		Sacramento River Weather Association	Parts of Sacramento, San Joaquin and Solano Counties	Mar. 5, 1958 May 23, 1958	22.7	135.0	90.0	4207	27	Hail suppression
6-58-1	Weather Modification Company	Kings River Conservation District	Kings River Basin above Pine Flat Reservoir	Nov. 1, 1957 Apr. 6, 1958	14.7	30.0		2068	118	Precipitation increase
6-58-3		Santa Clara County	Santa Clara County	Dec. 3, 1957 Apr. 20, 1958	13.5	13.5		1970	37	Precipitation increase
12-58-1	Precipitation Control Company of California	Kern County Board of Supervisors and Landowners	Northwest corner of Kern County	Nov. 5, 1957 Mar. 15, 1958	50				97	Precipitation increase
12-58-2		Kern County Board of Supervisors	High Sierra Watersheds of Eastern Tulare County	Nov. 16, 1957 Mar. 20, 1958	50				78	Precipitation increase
14-58-1	North American Weather Consultants	Southern California Edison Company	South Fork San Joaquin River Drainage Basin	Oct. 3, 1957 Apr. 4, 1958	6.7			3104		Precipitation increase
14-58-2		Pacific Gas and Electric Company	Mokelumne-Stanislaus Drainage Basin	Nov. 10, 1957 Mar. 21, 1958	6.7			7019		Precipitation increase
14-58-3		Pacific Gas and Electric Company	Crane Valley Reservoir Drainage Basin	Dec. 2, 1957 Mar. 21, 1958	6.7			1024		Precipitation increase
14-58-4		Pacific Gas and Electric Company	Lake Almanor Drainage Basin	Dec. 14, 1957 Mar. 21, 1958	6.7			5452		Precipitation increase
14-58-5		Ventura County	Ventura County	Dec. 16, 1957 Apr. 4, 1958	6.7			2476		Precipitation increase
14-58-6		Santa Barbara County Water Agency	Santa Barbara County	Dec. 4, 1957 Apr. 7, 1958	6.7			2264		Precipitation increase
17-58-1	Department of Natural Resources	Division of Forestry	Parts of Shasta, Lassen, Tehama, Butte, Plumas, Modoc Counties	July 2, 1957 Sept. 1, 1957	5.7			6518		Fire control
17-58-2		Division of Forestry	Parts of Mendocino, Humboldt, Trinity, and Siskiyou Counties	July 20, 1957 Sept. 25, 1957		37.8			35	Fire control
17-58-3		Division of Forestry	Parts of Lassen and Plumas Counties	July 15, 1958 Sept. 23, 1958	8.9			4729		Fire control
18-58-1	Los Angeles County Flood Control District	Los Angeles County Flood Control District	Above San Gabriel Dam	Jan. 12, 1958 Sept. 7, 1958	6.7			388		Precipitation increase

1/ Approximately 560 pounds of dry ice were used in 1.5 hours of aircraft seeding in addition to the listed seeding with silver iodide.
2/ Joint operation between California Electric Power Company and Weather Modification Company.
3/ Estimated weighted mean.


JULY
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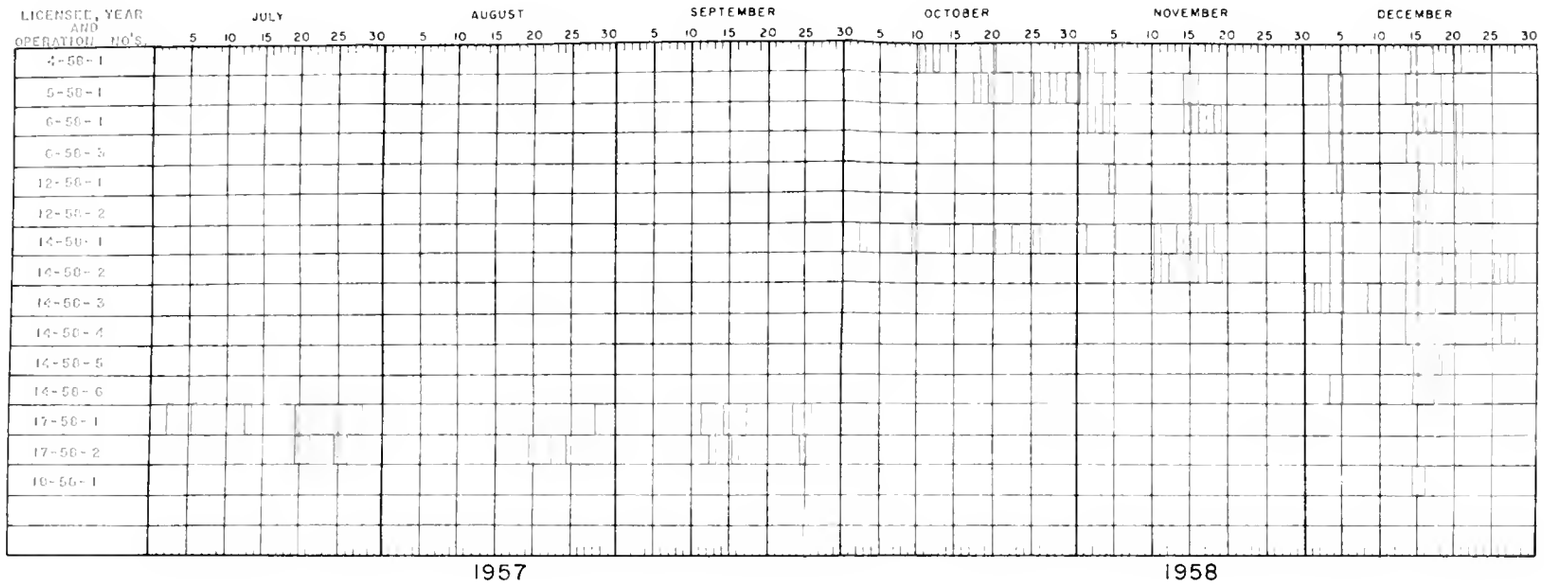
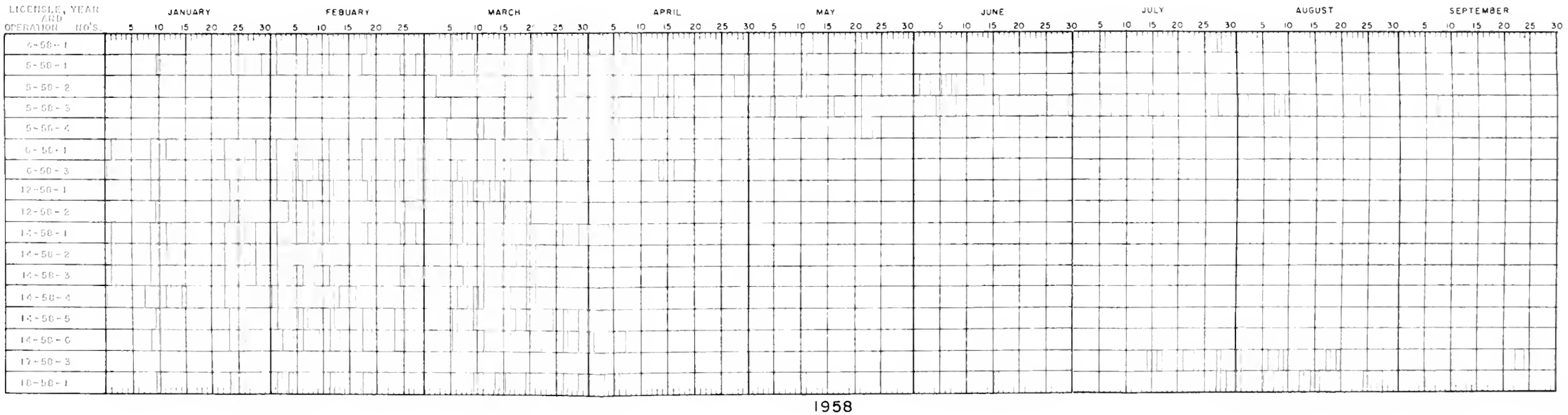




CALENDAR OF WEATHER MODIFICATION OPERATIONS

JULY 1957 THROUGH SEPT. 1958

DAYS OF CLOUD SEEDING SHOWN IN COLOR

DEPARTMENT OF WATER RESOURCES 1959

3-2

8-1
3-3

-4

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS

1957–1958

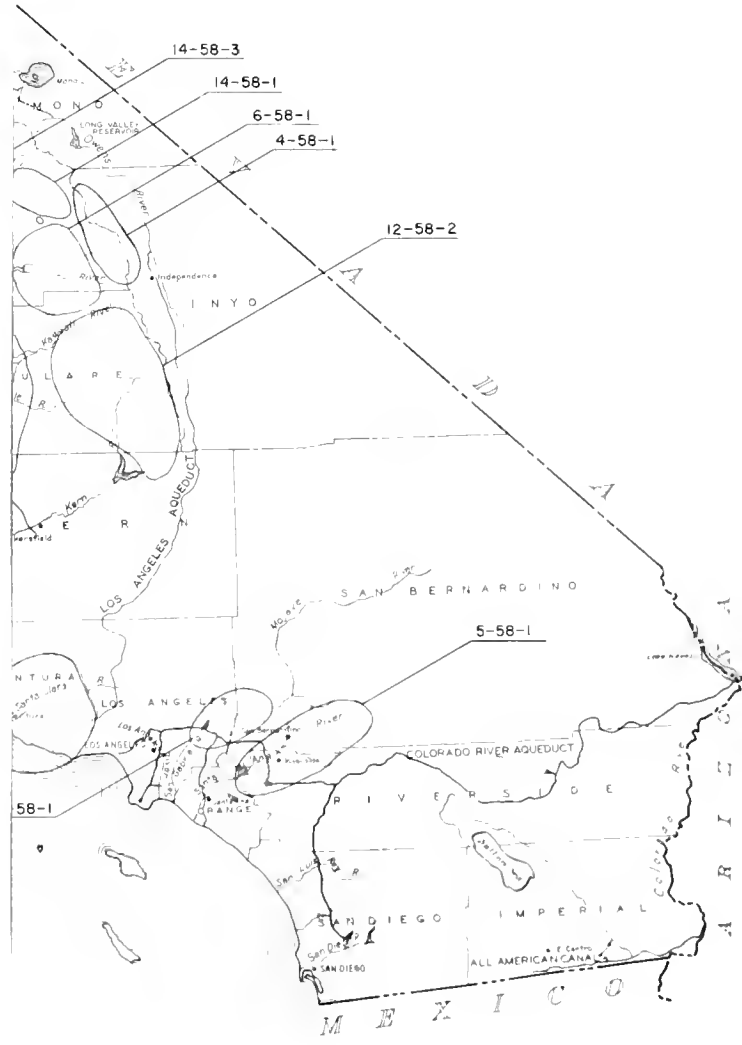
SCALE OF MILES
40 0 40 80

-2

8-4

NOTE
IDENTIFICATION NUMBERS REFER TO PROJECTS LISTED IN TABLE 2

14-58-2



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STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS

1957—1958

SCALE OF MILES
40 0 40 80

-2

8-4

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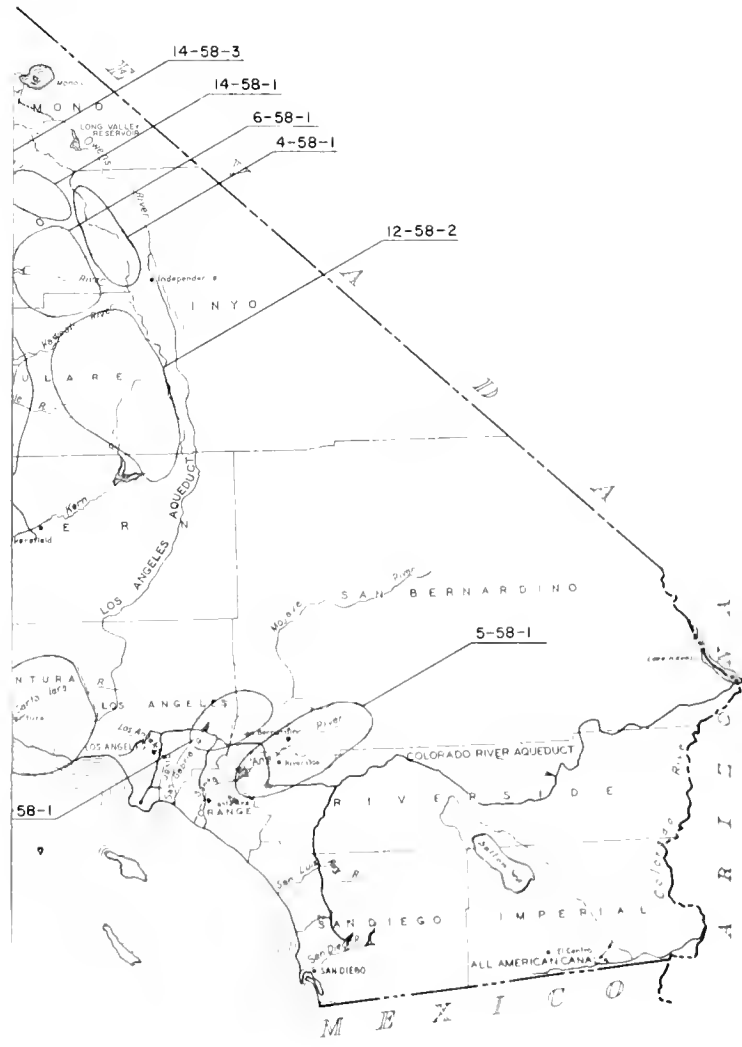
14-58-2



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS
1957–1958

APPENDIX A

CHAPTER 4, DIVISION 1 OF THE WATER CODE

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(d) The area which will be affected by the operation as near as the same may be determined in advance.

409. The licensee shall cause the notice of intention to be published at least once a week for three consecutive weeks in a newspaper having a general circulation and published within any county wherein the operation is to be conducted and in which the affected area is located, or, if the operation is to be conducted in more than one county or if the affected area is located in more than one county or is located in a county other than the one in which the operation is to be conducted, then such notice shall be caused to be published in

like manner in a newspaper having a general circulation and published within each of such counties. In case there is no newspaper published within the appropriate county, publication shall be made in a newspaper having a general circulation within the county.

(Amended by Stats. 1955, Ch. 482)

410. Proof of publication shall be filed by the licensee with the department within 15 days from the date of the last publication of the notice. Proof of publication shall be by copy of the notice as published attached to and made a part of the affidavit of the publisher or foreman of the newspaper publishing the notice.

411. Every licensee shall keep and maintain a record of all operations conducted by him pursuant to his license showing the method employed, the type of equipment used, the times and places of operation of the equipment, the name and post-office address of each person participating or assisting in the operation other than the licensee, and such other information as may be required by the department, and shall report the same to the department immediately upon the completion of each operation.

412. Each licensee shall further prepare and maintain an evaluation statement for each operation which shall include a report as to estimated precipitation, defining the gain or loss occurring from nucleation activities, together with supporting data therefor. This statement, together with such other pertinent information as the department may require, shall be sent to the department upon request by the department.

413. Notwithstanding any provision of this chapter to the contrary, the department may grant a licensee permission to undertake an emergency nucleation project, without compliance by the licensee with the provisions of Sections 407 to 410, inclusive, if the same appears to the department to be necessary or desirable in aid of extinguishment of fires.

413.5 Notwithstanding any provision of this chapter to the contrary, upon request of the board of supervisors of a county or of the governing body of a city or a public district of the State, and upon the submission of such supporting evidence as the department may require, the department may grant a licensee permission to undertake a nucleation project for the purpose of alleviating a drought emergency, without prior compliance by the licensee with the provisions of Section 407 requiring publication of notice of intention, if such project appears to the department to be necessary or desirable. Nothing contained in this section shall be construed as to relieve the licensee in such case from compliance with the provisions of Sections 407 to 410, inclusive, requiring publication of notice of intention and filing of proof of such publication, as soon after the granting of permission by the department as is practicable.

(Added by Stats. 1955, Ch. 1399.)

414. Any license may be revoked or suspended if the department finds, after due notice to the licensee and a hearing thereon, that the licensee has failed or refused to comply with any of the provisions of this chapter. The proceedings herein referred to shall be conducted in accordance with the provisions of the Administrative Procedure Act, Chapter 5, Part 1, Division 3, Title 2 of the Government Code and the department shall have all the powers granted therein.

415. Any person who violates any provision of this chapter is guilty of a misdemeanor.

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WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

AS REPORTED

TO THE DEPARTMENT OF WATER RESOURCES

OCTOBER, 1958 – SEPTEMBER, 1959

EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director of Water Resources

FEBRUARY, 1960

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

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VEY O. BANKS
DIRECTOR

EDMUND G BROWN
GOVERNOR

ADDRESS REPLY TO
P. O. BOX 388 SACRAMENTO 2
1120 N STREET HICKORY 5-4711

STATE OF CALIFORNIA

Department of Water Resources

SACRAMENTO

February 29, 1960

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources entitled "Weather Modification Operations in California, as Reported to the Department of Water Resources, October, 1958-September, 1959."

During the period covered by the report, there were 17 projects involving weather modification operations which were undertaken in California. These were accomplished by seven operators who were licensed by the Department for such activities.

Very truly yours,

Harvey O. Banks

HARVEY O. BANKS
Director

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WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER, 1958, THROUGH SEPTEMBER, 1959

INTRODUCTION

In July, 1951, the State Legislature enacted Chapter 1677, Statutes of 1951, for the regulation and licensing of weather modification in the State of California. This act, which was codified in 1953 as Chapter 4, Division 1, of the Water Code, provides that:

> "No person, without first securing a license from the Department shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent, or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere".

Appendix A of this report contains statutory provisions pertinent to artificial weather modification activities.

At the conclusion of each weather modification project, licensees are required by law to submit a completion report. These reports include such information as the name or agency sponsoring the project, location of operation, log of all seeding operations, cloud seeding techniques and type of equipment used, and the names of all persons who assisted in the operation. This annual report of weather modification operations in California is a summary of the completion reports submitted by the licensees. This report on weather modification operations includes records of operation throughout the State for the period of October 1, 1958, through September 30, 1959.

A complete record of weather modification operations since 1951 (the year legislative action began the licensing and regulating of such

operations) is available in the files of the Department. In addition, a detailed report dealing with the theory of weather modification, evaluation of methods and results, and a schedule of cloud seeding operations from 1947 through 1952 may be found in Bulletin No. 16 dated June, 1955, by the State Water Resources Board. Summaries of weather modification operations in California have been published as follows:

Period of Operations	Publication
January, 1947 - June, 1952	State Water Resources Board Bulletin No. 16, - June, 1955
July, 1952 - June, 1956	"Weather Modification Operations in California" - January, 1957
July, 1956 - June, 1957	"Weather Modification Operations in California" - July, 1958
July, 1957 - September, 1958	"Weather Modification Operations in California" - July, 1959

SUMMARY OF OPERATIONS

During the period covered by this report, October, 1958, through September, 1959, weather modification operations were conducted throughout the State from Lassen County in the north to Riverside County in the south. The majority of operations were concentrated along the western slope of the Sierra Nevada for the purpose of increasing precipitation on watersheds above hydroelectric installations. In northern mountainous regions, one cloud-seeding project was designed to reduce forest fire hazards by eliminating lightning. Precipitation increase was the purpose for seeding activities in the South Coastal Area.

Cloud-seeding operations during 1958-59 included 17 projects: 14 for increasing precipitation, two for suppressing hail, and one to eliminate lightning. Between October 23, 1958, and September 15, 1959, an estimated 398,000 grams, or 880 pounds of silver iodide were released. Total estimated operating time was 28,600 generator-hours in 3,178 generator-days during 102 calendar days. Due to the fact that the period covered by the report has been a dry one, the opportunity for seeding operations has been less, hence, the amount of silver iodide released during 1958-59 was only 61 per cent of that released during a comparable period in 1957-58. Operating time this year was 58 per cent of last season's total generator-hours. One factor which influences this percentage of operating time is that seeding operations last year were conducted on 205 calendar days out of a possible 365, or 56 per cent of the time. This year, the 102 operating days were only 28 per cent of the possible 365 days.

The 17 operations in 1958-59 were conducted by seven of the nine licensed concerns. Table 1 lists all licenses which were in force during the period covered by this report. The Department of Water Resources is not a cloud seeding agency but merely acts as the licensor.

Weather modification projects in California conducted during the period from October, 1958, through September, 1959, are listed in Table 2. Each project is designated by a compound number consisting of three components. The first element is the license number, the second indicates the fiscal year of operation, and the third is assigned in numerical sequence to projects undertaken by a licensee during the year, as shown by published notices of intention of operation filed with the Department. A daily log of cloud seeding is presented on Plate 1 and the approximate areas affected are delineated on Plate 2.

TABLE 1

WEATHER MODIFICATION CONCERNS THAT WERE LICENSED TO OPERATE
DURING THE PERIOD FROM OCTOBER, 1958, THROUGH SEPTEMBER, 1959

License Number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport, Goleta, California
4	California Electric Power Company* 3771 8th Street, Riverside, California
5	Water Resources Development Corporation 460 South Broadway, Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport, San Jose 10, California
12	Precipitation Control Company of California 105 Pierce Street, Taft, California
14	North American Weather Consultants of California Santa Barbara Municipal Airport, Goleta, California
17	Department of Natural Resources, Division of Forestry State Office Building No. 1, Sacramento 14, California
18	Los Angeles County Flood Control District Box 2418, Terminal Annex, Los Angeles 54, California
19	Weather Engineers, Incorporated ** P.O. Box 2269, Loomis, California

* License expired December 31, 1958
** License issued January 7, 1959

TABLE 2

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
October 1, 1958 - September 30, 1959

Operation Number	Licensee	Client	Target Area	Period of Operation	Rate of Use of Silver Iodide in Grams Per Hour			Total Generator Hours		Purpose
					Ground Base	Air-Borne	Mobile Gr. Base	Ground	Air	
5-59-1	Water Resources Development Corp.	Placer County Farm Labor Coop., Inc.	Parts of Placer, Nevada and El Dorado Counties	Mar. 23, 1959 May 26, 1959	17.1*	225.0	45.9*	1897	46	Hail suppression
5-59-2		Sacramento River Weather Association	Parts of Sacramento, San Joaquin, and Solano Counties	Mar. 3, 1959 May 1, 1959	20.1*	225.0		520	12	Hail suppression
6-59-1	Weather Modification Company	Kings River Conservation District	Kings River Basin above Pine Flat Reservoir	Nov. 10, 1958 Apr. 26, 1959	11.0	35.0		1175	68	Precipitation inorease
6-59-2		David McCoy	Mammoth Mountain in Mammoth Lake Area	Dec. 21, 1958 Dec. 27, 1958		15.0			4	Precipitation increase
6-59-3		Santa Clara County	Santa Clara County	Dec. 21, 1958 Feb. 21, 1959	11.0	35.0		1312	38	Precipitation inorease
12-59-1	Precipitation Control Company of California	Kern County Board of Supervisors and landowners	Northwest corner of Kern County	Nov. 11, 1958 Apr. 26, 1959		50.0			66	Precipitation increase
12-59-2		Kern County Board of Supervisors	Kern River Drainage Basin	Dec. 27, 1958 May 3, 1959		50.0			65	Precipitation increase
14-59-1	North American Weather Consultants of California	Southern California Edison Company	South Fork San Joaquin River Drainage Basin	Nov. 10, 1958 June 21, 1959	6.7			2219		Precipitation inorease
14-59-2		Pacific Gas and Electric Company	Mokelumne, Stanislaus, and Bear Rivers Drainage Basin	Nov. 9, 1958 May 24, 1959	6.7			5792		Precipitation increase

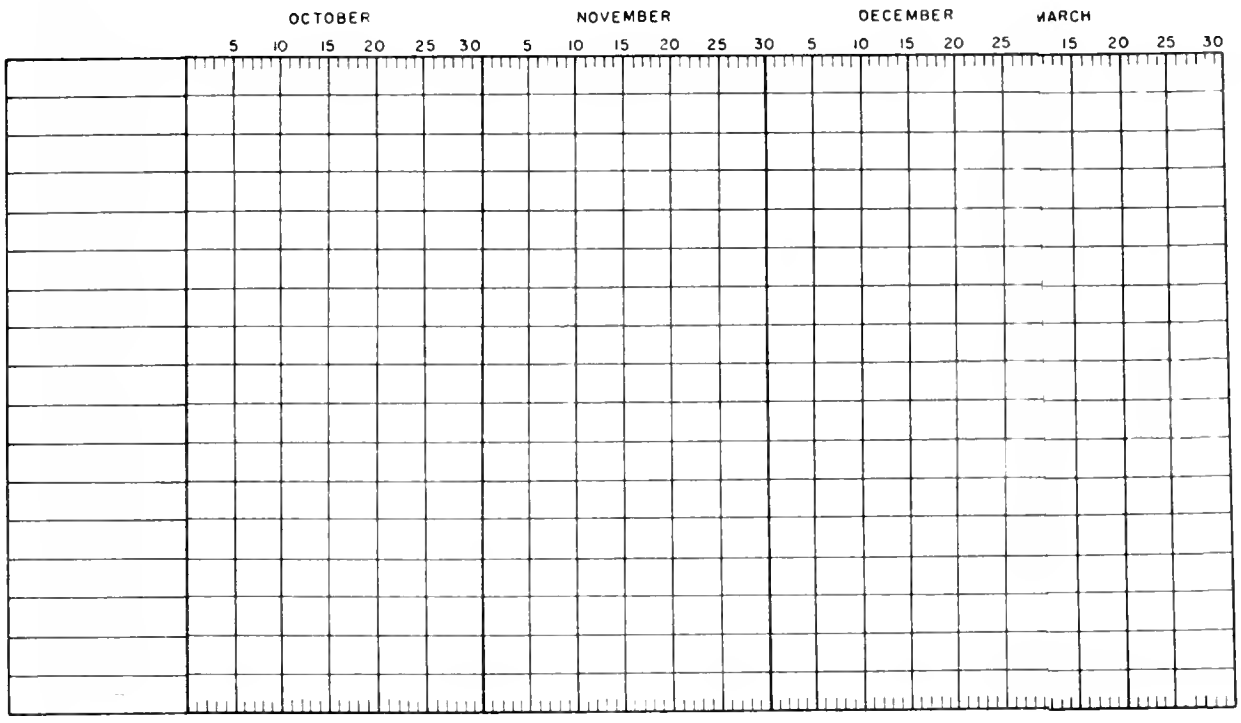
* Estimated weighted mean.

TABLE 2 (continued)

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
October 1, 1958 - September 30, 1959

Operation Number	Licensee	Client	Target Area	Period of Operation	Rate of Use of Silver Iodide in Grams Per Hour			Total Generator Hours		Purpose
					Ground Base	Air-borne	Mobile Gr. Base	Ground	Air	
14-59-3	North American Weather Consultants of California	Pacific Gas and Electric Company	Crane Valley Reservoir Drainage Basin	Nov. 10, 1958 May 1, 1959	6.7			564		Precipitation increase
14-59-4		Pacific Gas and Electric Company	Lake Almanor Drainage Basin	Dec. 8, 1958 May 26, 1959	6.3*			5609		Precipitation increase
14-59-5		Ventura County	Ventura County	Jan. 5, 1959 May 1, 1959	6.7			621		Precipitation increase
14-59-6		Santa Barbara County Water Agency	Santa Barbara County	Jan. 5, 1959 May 1, 1959	6.7			612		Precipitation increase
14-59-7		Santa Ana River Weather Corp.	San Jacinto River Drainage Basin	Oct. 23, 1958 May 3, 1959	6.7			2106		Precipitation increase
17-59-1	Department of Natural Resources	Division of Forestry	Eagle Lake area, Lassen County	July 11, 1959 Sept. 15, 1959	26.3			3561		Fire Control
18-59-1	Los Angeles County Flood Control District	Los Angeles County Flood Control Control District	Above San Gabriel Dam	Oct. 23, 1958 Sept. 13, 1959	6.0			183		Precipitation increase
19-59-1	Weather Engineers, Inc.	Southern Sierra Corporation	Western Slope of Sierra Nevada Mountains in Kern and Tulare Counties	Jan. 5, 1959 Apr. , 1959	45.0	45.0		2024	60	Precipitation increase

* Estimated weighted mean.



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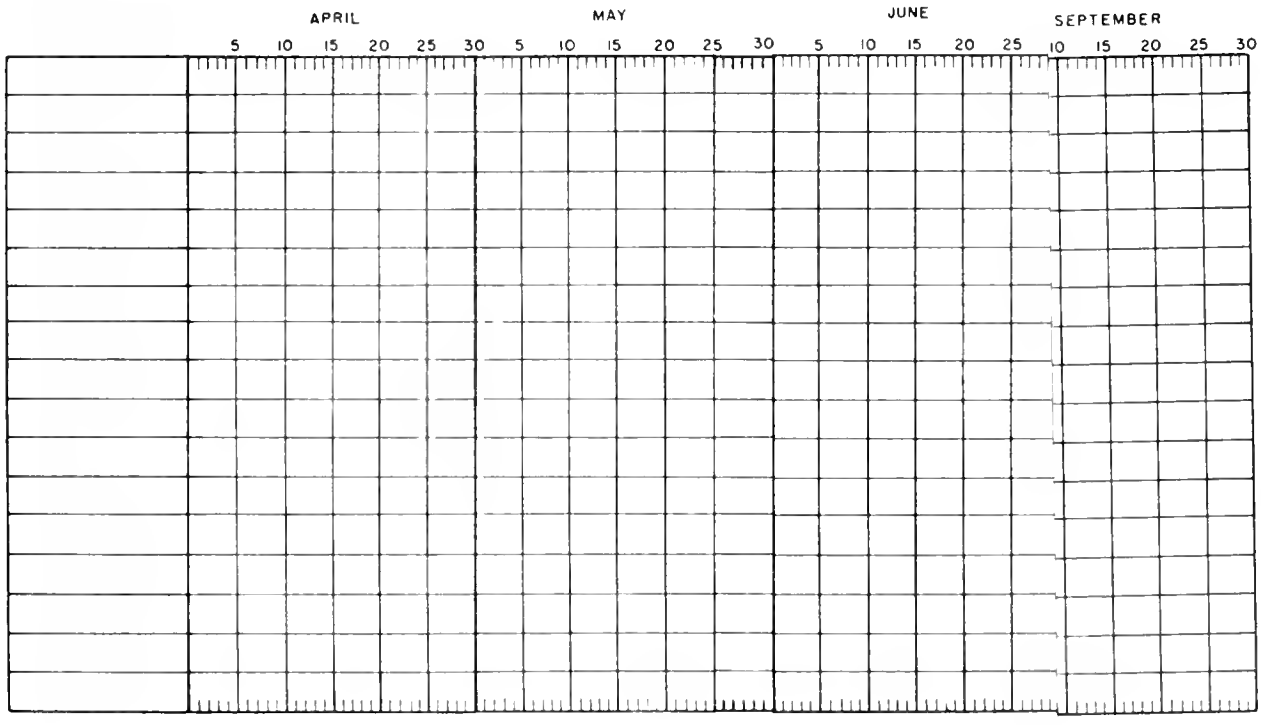

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OCTOBER 1958 THROUGH SI

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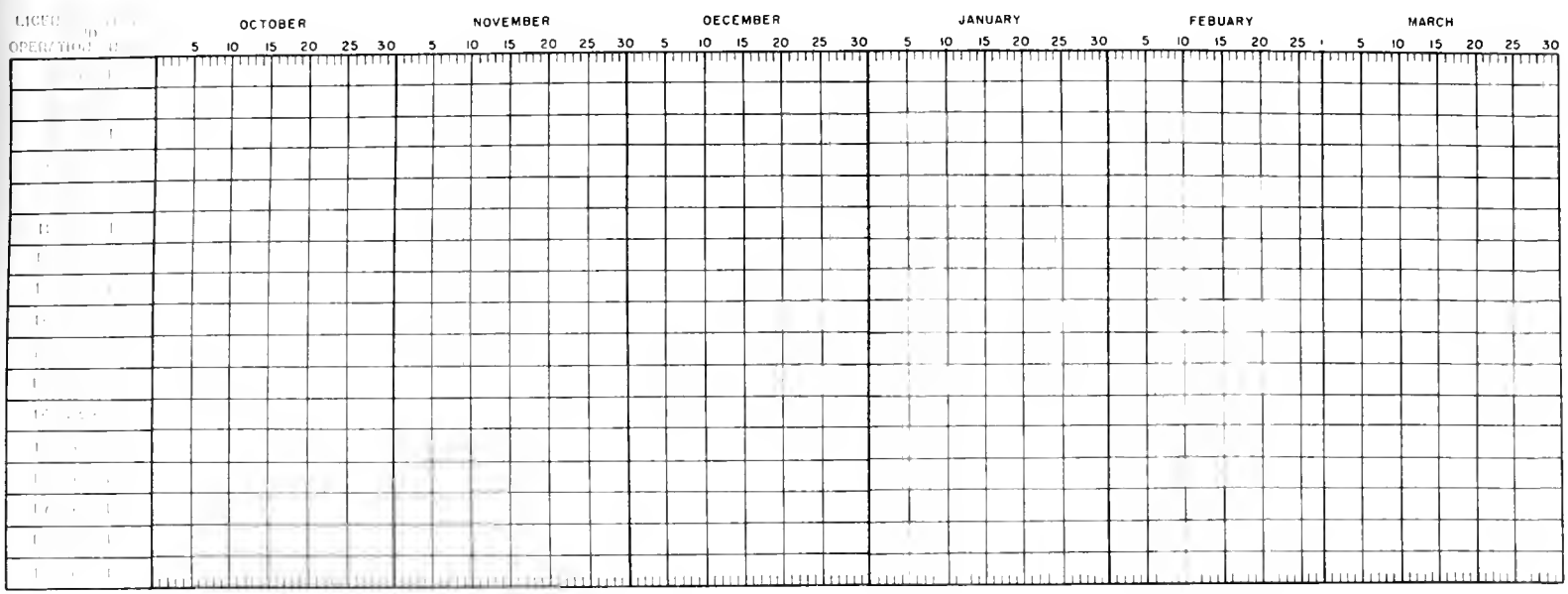

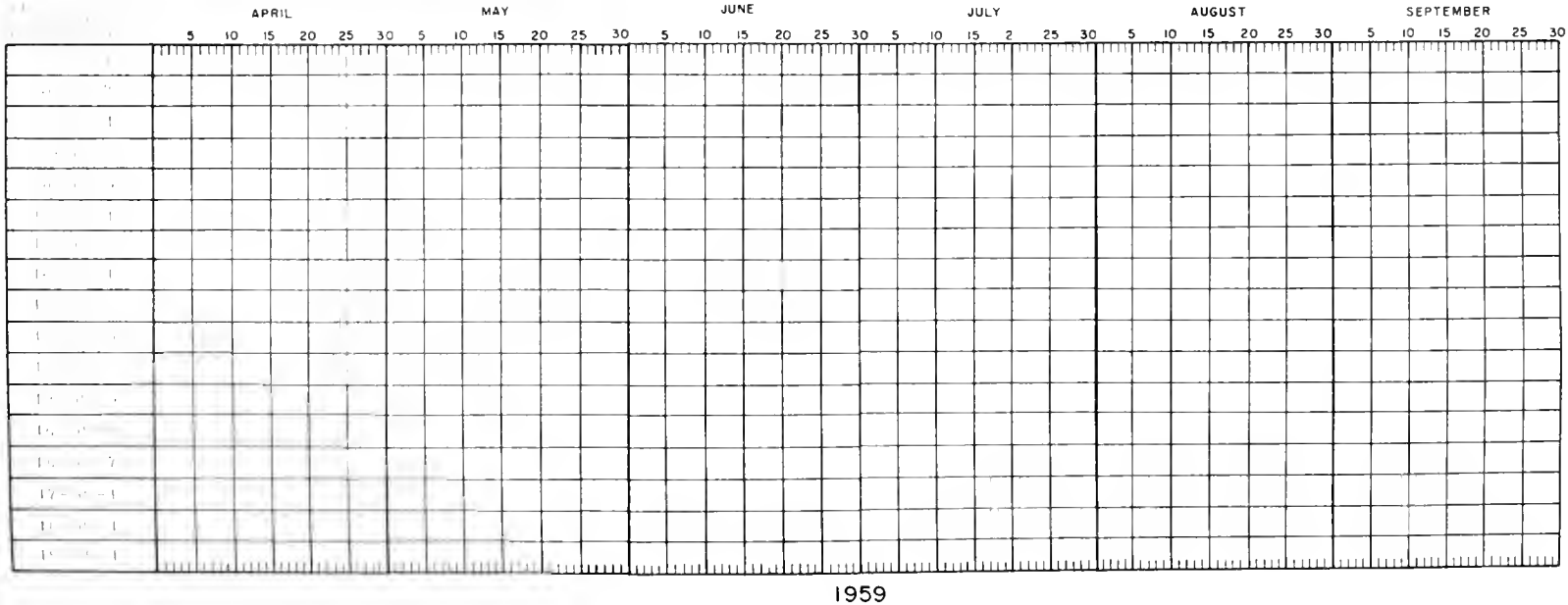

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OCTOBER 1958 THROUGH SEPTEMBER 1959

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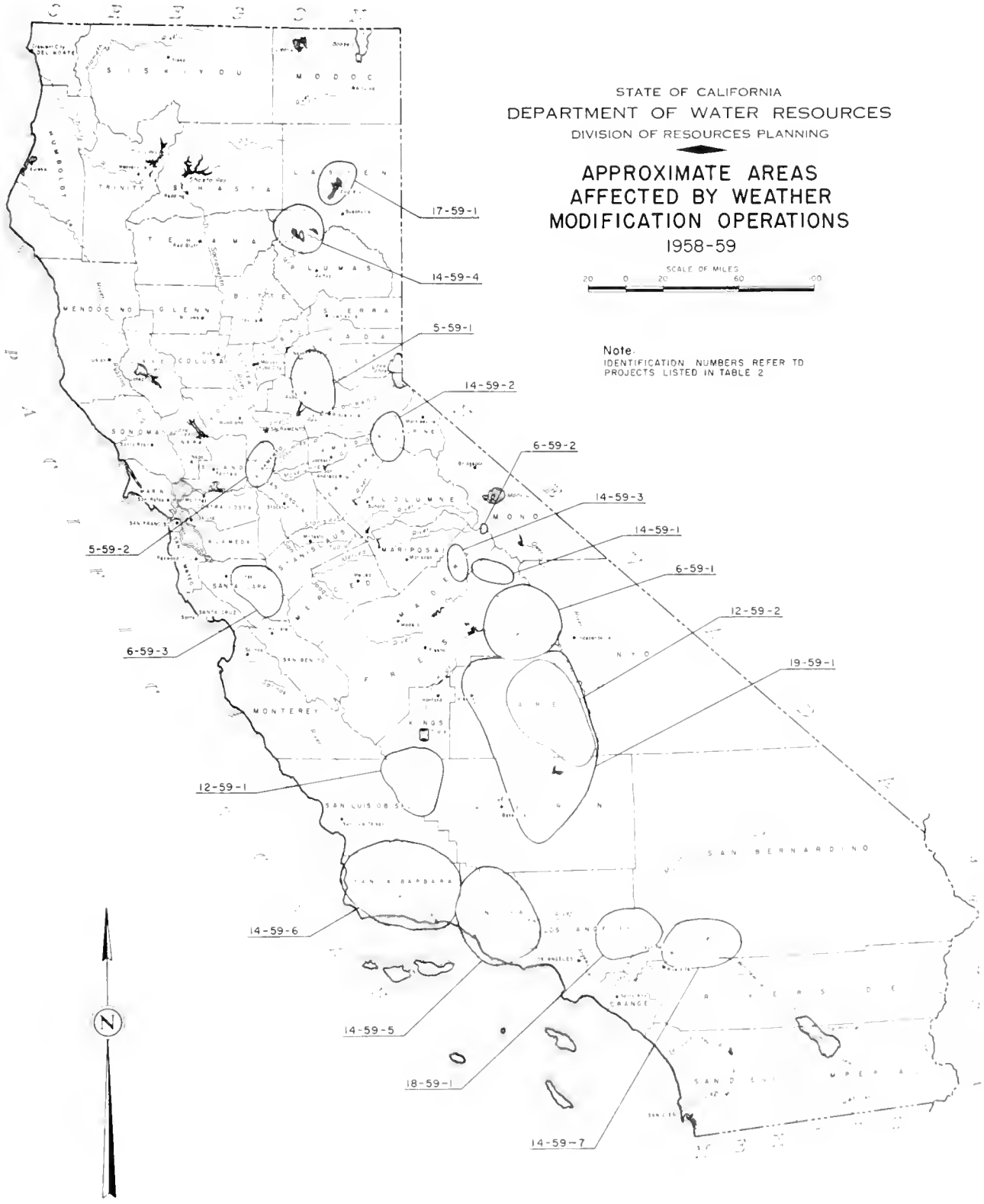
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DEPARTMENT OF WATER RESOURCES
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APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS
1958-59
SCALE OF MILES
20 0 20 60 100
Note:
IDENTIFICATION NUMBERS REFER TO PROJECTS LISTED IN TABLE 2
17-59-1
14-59-4
5-59-1
14-59-2
6-59-2
14-59-3
14-59-1
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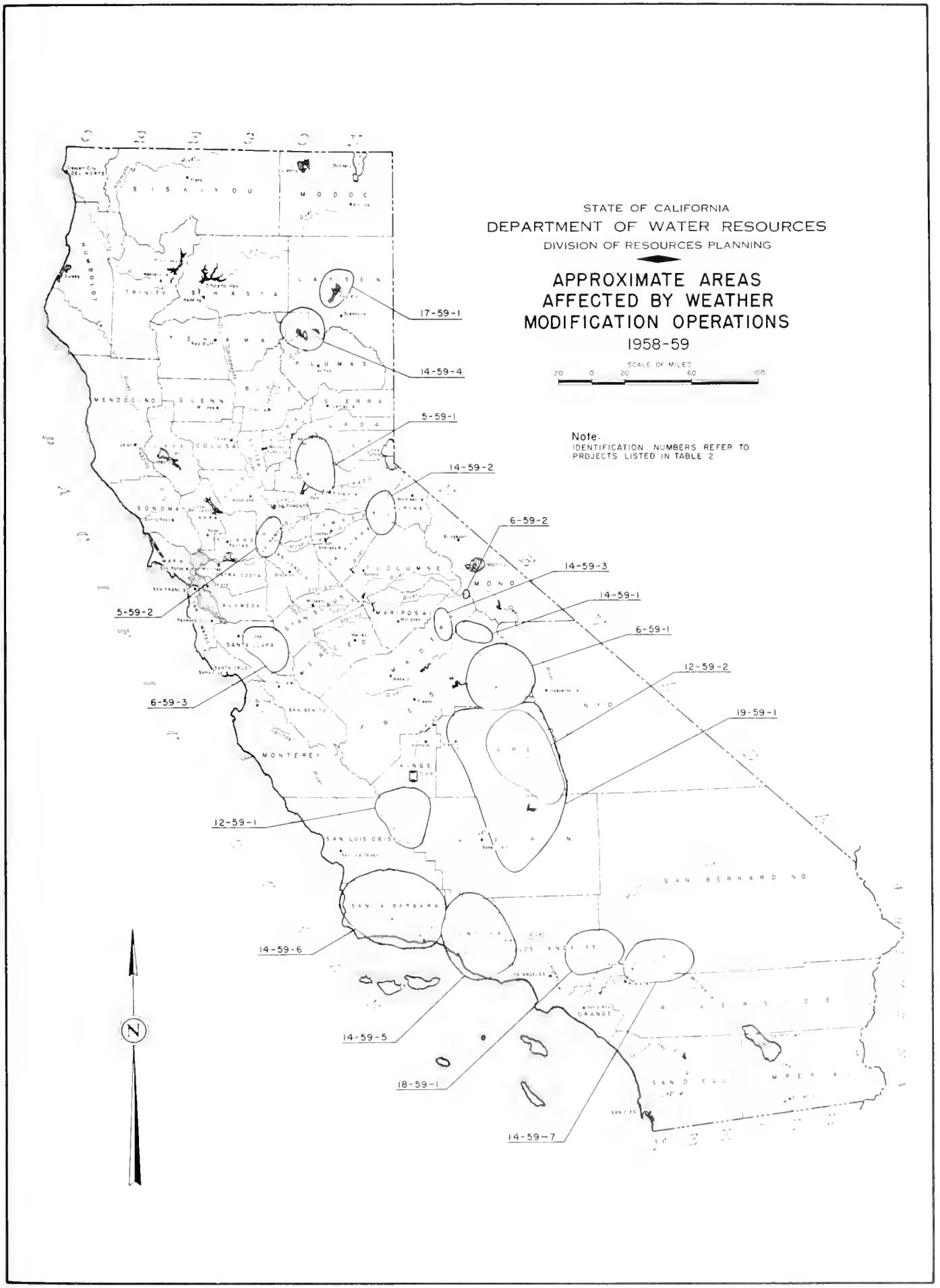
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19-59-1
5-59-2
6-59-3
12-59-1
14-59-6
14-59-5
18-59-1
14-59-7
SISKIYOU
MODOC
HUMBOLDT
TRINITY
SHASTA
LASSEN
TEHAMA
PLUMAS
MENDOCINO
GLENN
BUTTE
SIERRA
COLUSA
SONOMA
TUOLUMNE
MONO
MARIPOSA
ALAMEDA
SANTA CLARA
MONTEREY
KINGS
SAN LUIS OBISPO
SAN BERNARDINO
SAN BARBARA
LOS ANGELES
ORANGE
RIVERSIDE
SAN DIEGO
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APPENDIX A

CHAPTER 4, DIVISION 1 OF THE WATER CODE

CHAPTER 4, DIVISION 1 OF THE WATER CODE, STATE OF CALIFORNIA

REGULATION OF RAIN-MAKING AND RAIN-PREVENTION

(Chapter 4 added by Stats. 1953, Ch. 139, as part of codification)

400. The public interest, health, safety, welfare, and necessity require that scientific experimentation in the field of artificial nucleation, and that scientific efforts to develop, increase, and regulate natural precipitation be encouraged, and that means be provided for the regulation and control of interference by artificial means with natural precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, within the State, in order to develop, conserve, and protect the natural water resources of the State and to safeguard life and property.

401. As used in this chapter:

(a) "Department"* means the Department of Public Works acting through the State Engineer.

(b) "Person" means any person, firm, association, organization, partnership, company, corporation, private or public, county, city, city and county, district, or other public agency.

402. No person, without first securing a license from the department, shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere.

403. Any person desiring to do any of the acts specified in Section 402 may file with the department an application in writing for a license. Each application shall be accompanied by a filing fee fixed by the department with the approval of the Department of Finance but not to exceed fifty dollars ($50) and shall be on a form to be supplied for such purpose by the department.

404. Every application shall set forth all of the following:

(a) The name and post-office address of the applicant.

* Pursuant to provisions of Sec. 153, Chap. 52, Stats. first extra session, 1956, the Department of Water Resources ". . . succeeds to and is vested with all of the powers, duties, purposes, responsibilities, and jurisdiction in matters pertaining to water or dams vested in the Department and Director of Public Works, the Division of Water Resources of the Department of Public Works, the State Engineer . . . or any officer or employee thereof." This chapter became effective on July 5, 1956.

(b) The previous education, experience, and qualifications of the applicant, or, if the applicant is other than an individual, the previous education, experience, and qualifications of the persons who will be in control of and charged with the operations of the applicant.

(c) A general description of the operations which the applicant intends to conduct and the method and type of equipment that the applicant proposes to use.

(d) Such other pertinent information as the department may require.

405. Upon the filing of the application upon a form supplied by the department and containing the information prescribed by this chapter and accompanied by the required filing fee the department shall issue a license to the applicant entitling the applicant to conduct the operations described in the application for the calendar year for which the license is issued, unless the license is sooner revoked or suspended.

406. A license may be renewed annually upon application to the department, accompanied by a renewal fee fixed by the department with the approval of the Department of Finance but not to exceed twenty-five dollars ($25), on or before the last day of January of the calendar year for which the license is renewed.

407. Prior to undertaking any operation authorized by the license the licensee shall file with the department and cause to be published a notice of intention. The licensee shall then confine his activities for that operation substantially within the time and area limits set forth in the notice of intention.

408. The notice of intention shall set forth all of the following:

(a) The name and address of the licensee.

(b) The nature and object of the intended operation and the person or persons on whose behalf it is to be conducted.

(c) The area in which and the approximate time during which the operation will be conducted.

(d) The area which will be affected by the operation as near as the same may be determined in advance.

409. The licensee shall cause the notice of intention to be published at least once a week for three consecutive weeks in a newspaper having a general circulation and published within any county wherein the operation is to be conducted and in which the affected area is located, or, if the operation is to be conducted in more than one county or if the affected area is located in more than one county or is located in a county other than the one in which the operation is to be conducted, then such notice shall be caused to be published in

like manner in a newspaper having a general circulation and published within each of such counties. In case there is no newspaper published within the appropriate county, publication shall be made in a newspaper having a general circulation within the county.
(Amended by Stats. 1955, Ch. 482)

410. Proof of publication shall be filed by the licensee with the department within 15 days from the date of the last publication of the notice. Proof of publication shall be by copy of the notice as published attached to and made a part of the affidavit of the publisher or foreman of the newspaper publishing the notice.

411. Every licensee shall keep and maintain a record of all operations conducted by him pursuant to his license showing the method employed, the type of equipment used, the times and places of operation of the equipment, the name and post-office address of each person participating or assisting in the operation other than the licensee, and such other information as may be required by the department, and shall report the same to the department immediately upon the completion of each operation.

412. Each licensee shall further prepare and maintain an evaluation statement for each operation which shall include a report as to estimated precipitation, defining the gain or loss occurring from nucleation activities, together with supporting data therefor. This statement, together with such other pertinent information as the department may require, shall be sent to the department upon request by the department.

413. Notwithstanding any provision of this chapter to the contrary, the department may grant a licensee permission to undertake an emergency nucleation project, without compliance by the licensee with the provisions of Sections 407 to 410, inclusive, if the same appears to the department to be necessary or desirable in aid of extinguishment of fires.

413.5 Notwithstanding any provision of this chapter to the contrary, upon request of the board of supervisors of a county or of the governing body of a city or a public district of the State, and upon the submission of such supporting evidence as the department may require, the department may grant a licensee permission to undertake a nucleation project for the purpose of alleviating a drought emergency, without prior compliance by the licensee with the provisions of Section 407 requiring publication of notice of intention, if such project appears to the department to be necessary or desirable. Nothing contained in this section shall be construed as to relieve the licensee in such case from compliance with the provisions of Sections 407 to 410, inclusive, requiring publication of notice of intention and filing of proof of such publication, as soon after the granting of permission by the department as is practicable.
(Added by Stats. 1955, Ch. 1399)

414. Any license may be revoked or suspended if the department finds, after due notice to the licensee and a hearing thereon, that the licensee has failed or refused to comply with any of the provisions of this chapter. The proceedings herein referred to shall be conducted in accordance with the provisions of the Administrative Procedure Act, Chapter 5, Part 1, Division 3, Title 2 of the Government Code and the department shall have all the powers granted therein.

415. Any person who violates any provision of this chapter is guilty of a misdemeanor.

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WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

AS REPORTED

TO THE DEPARTMENT OF WATER RESOURCES

OCTOBER, 1959 – SEPTEMBER, 1960

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EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director of Water Resources

December, 1960

STATE OF CALIFORNIA
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DIVISION OF RESOURCES PLANNING

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

AS REPORTED

TO THE DEPARTMENT OF WATER RESOURCES

OCTOBER, 1959 — SEPTEMBER, 1960

EDMUND G. BROWN
Governor

HARVEY O. BANKS
Director of Water Resources

December, 1960

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2	CALENDAR OF WEATHER MODIFICATION OPERATIONS, OCTOBER, 1959, THROUGH SEPTEMBER, 1960

ARVEY O. BANKS
DIRECTOR

EDMUND G. BROWN
GOVERNOR

ADDRESS REPLY TO
P. O. BOX 388 SACRAMENTO 2
1120 N STREET HICKORY 6-4711

STATE OF CALIFORNIA

Department of Water Resources

SACRAMENTO

December 20, 1960

Honorable Edmund G. Brown, Governor,
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources entitled "Weather Modification Operations in California, as Reported to the Department of Water Resources, October, 1959 - September, 1960".

During the period covered by the report, there were 13 projects involving weather modification operations which were undertaken in California. These were accomplished by five of the ten operators who were licensed by the department for such activities.

Very truly yours,

Harvey O. Banks

HARVEY O. BANKS
Director

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER, 1959, THROUGH SEPTEMBER, 1960

INTRODUCTION

In July, 1951, the State Legislature enacted Chapter 1677, Statutes of 1951, for the regulation and licensing of weather modification in the State of California. This act, which has since been codified as Chapter 4, Division 1, of the Water Code, provides that:

> "No person, without first securing a license from the department shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent, or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere".

Once a license is obtained, the licensee is free to operate at any time or place he chooses, provided he follows certain regulations pertaining to public notification. At the conclusion of each of their weather modification projects, licensees are required by law to submit a completion report to the Department of Water Resources. These reports include such information as the name of the agency sponsoring the project, location of the project, log of all seeding operations, cloud-seeding techniques and type of equipment used, and the names of all persons who assisted in the operation. These completion reports submitted by the licensees are summarized by the department in an annual report on weather modification operations in California. This report, which is the fifth in the series, summarizes completion reports on all operations conducted in the State during the period of October 1, 1959, through September 30, 1960.

A complete record of weather modification operations since 1951 (the year legislative action began the licensing and regulating of operations) is

available in the files of the department. In addition, a detailed report dealing with the theory of weather modification, evaluation of methods and results, and a schedule of cloud-seeding operations from 1947 through 1952 was published as Bulletin No. 16, "Weather Modification Operations in California", in June, 1955, by the State Water Resources Board. Subsequent summaries of weather modification operations in California have been published by the Department of Water Resources as follows:

Period of Operations	Publication
July, 1952 - June, 1956	Weather Modification Operations in California - January, 1957
July, 1956 - June, 1957	Weather Modification Operations in California - July, 1958
July, 1957 - September, 1958	Weather Modification Operations in California - July, 1959
October, 1958 - September, 1959	Weather Modification Operations in California - February, 1960

SUMMARY OF 1959-60 OPERATIONS

During the period covered by this report (October, 1959, through September, 1960), 13 weather modification operations were conducted in that portion of the State from Plumas County in the north to Riverside County in the south. Of the 13 cloud-seeding projects, ten were for the stated purpose of increasing precipitation, two were for increasing snow, and one was for suppressing hail. Several of these operations were concentrated along the western slope of the Sierra Nevada for the purpose of increasing precipitation on watersheds above hydroelectric installations. Precipitation increase was also the purpose of all of the seeding projects in Southern California. The projects which were conducted for the purpose of increasing snowpack for recreational purposes were located on the east side of the Sierra. Approximate areas affected by cloud-seeding operations during 1959-60 are shown on Plate 1.

The year covered by this report was an extremely dry one, hence the opportunity for seeding operations was limited. Total estimated operating time on all projects was 30,060 generator-hours. All projects used silver iodide as a nucleating agent, except for an experimental use of carbon black lasting 45 minutes. During the year, an estimated 313,900 grams, or 692 pounds, of silver iodide were released. The amount of silver iodide released during the 1959-60 season was only 79 per cent of that released during the previous 1958-59 season. Total operating time during the 1959-60 season, however, was 105 per cent of the previous season's. Of the 366 calendar days during the year covered by this report, seeding operations were conducted on 107 days, as opposed to 102 days for the 1958-59 season.

The 13 operations in 1959-60 were conducted by five of the ten licensed contractors. During the year covered by this report, one license was not renewed and two new licenses were issued. Table 1 lists all licenses which were in force during the period.

The Department of Water Resources is not a cloud-seeding agency, but merely acts as a licensor. However, during the period covered by this report, the department supported cloud-seeding operations in Santa Barbara County as part of an experiment designed to determine the effects of such operations on precipitation. Results of this experiment have been published by the department in the "Interim Report, Santa Barbara Weather Modification Project".

Projects conducted in California during the 1959-60 season are listed in Table 2, together with pertinent data on number of generator-hours, rate of use of silver iodide, etc. Each project in the table is designated by a coding number consisting of three elements. The first element is the license number, the second indicates the water year, and the third is assigned in numerical sequence to projects undertaken by a licensee during the year and as shown by

published notices of intention filed with the department. This code number is used to identify the project for which the daily cloud-seeding operations are shown on Plate 2, and for which the approximate areas affected by such operations are shown on Plate 1.

TABLE I

HOLDERS OF WEATHER MODIFICATION LICENSES FOR OPERATION DURING THE PERIOD FROM OCTOBER, 1959, THROUGH SEPTEMBER, 1960

License Number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport Goleta, California
5	Water Resources Development Corporation 460 South Broadway Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport San Jose 10, California
12	Precipitation Control Company of California 105 Pierce Street Taft, California
14	North American Weather Consultants of California Santa Barbara Municipal Airport Goleta, California
17	Department of Natural Resources Division of Forestry Office Building No. 1 Sacramento 14, California
18	Los Angeles County Flood Control District Box 2418, Terminal Annex Los Angeles 54, California
19	Weather Engineers, Incorporated* P. O. Box 2269 Loomis, California
20	International Weather Control, Inc.** 40 West First Street Reno, Nevada
21	Atmospherics Incorporated*** 3796 East Austin Way Fresno 26, California

* License expired December 31, 1959.
** License issued July 8, 1960.
*** License issued August 10, 1960.

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1, 1959 - SEPTEMBER 30, 1960

Project Number	Licensee	Client	Target Area	Period of Operation	Rate of Use of Silver Iodide in Grams Per Hour			Total Generator Hours			Purpose
					Ground Base	Air-Borne	Mobile Ground Base	Ground	Air	Mobile	
5-60-1	Water Resources Development Corporation	Placer County Farm Labor Coop.	Parts of Placer, Nevada, and El Dorado Counties	Mar. 26, 1960 May 25, 1960	22.0*	260.0**	32.0	3,771	84.2	16	Hail Suppression
5-60-2		Organizing Committee of the VIII Olympic Games	Squaw Valley area, Placer County	Dec. 12, 1959 Feb. 18, 1960	13.2*		4.0	508		6	Snow increase
6-60-1	Weather Modification Company	Kings River Conservation District	Kings River Basin above Pine Flat Reservoir	Nov. 1, 1959 Apr. 30, 1960	15.0	25.0		3,226	56.0		Precipitation increase
6-60-2		Mammoth Mountain Ski Tows	Mammoth Mountain Area	Dec. 20, 1959 Feb. 9, 1960		25.0			3.0		Snow increase
6-60-3		Santa Clara Valley Water Conservation District	Santa Clara County	Dec. 12, 1959 Mar. 13, 1960	9.6*	35.0		1,000	14.0		Precipitation increase
12-60-1	Precipitation Control Company of California	Kern County Board of Supervisors Landowners in area	Northwest corner of Kern County	Dec. 24, 1959 Apr. 27, 1960		43.0			68.0		Precipitation increase
14-60-1	North American Weather Consultants of California	Southern California Edison Company	South Fork San Joaquin River Drainage Basin	Dec. 12, 1959 May 4, 1960	6.7			2,672			Precipitation increase
14-60-2		Pacific Gas and Electric Company	Mokelumne, Stanislaus, and Bear Rivers Drainage Basin	Dec. 12, 1959 May 25, 1960	6.7			6,869			Precipitation increase
14-60-3		Santa Ana River Weather Corporation	Santa Ana River Drainage Basin	Dec. 8, 1959 May 5, 1960	6.7			2,406			Precipitation increase
14-60-4		Pacific Gas and Electric Company	Lake Almanor Drainage Basin	Dec. 11, 1959 May 25, 1960	6.4*			6,698			Precipitation increase
14-60-5		Ventura County Flood Control District	Ventura County	Jan. 9, 1960 Feb. 29, 1960	6.7			1,026			Precipitation increase
14-60-6		State of California Department of Water Resources	Santa Barbara County	Jan. 9, 1960 Apr. 27, 1960	6.7			1,400			Precipitation increase
18-60-1	Los Angeles County Flood Control District	Los Angeles County Flood Control District	Drainage area above San Gabriel Dam	Nov. 1, 1959 Sept. 10, 1960	8.8*			231			Precipitation increase

* Estimated weighted mean.
** Air-borne total includes an experiment, lasting 45 minutes and using carbon black as an agent, conducted on March 26, 1960, from an AT-6 aircraft.

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

DIVISION OF RESOURCES PLANNING

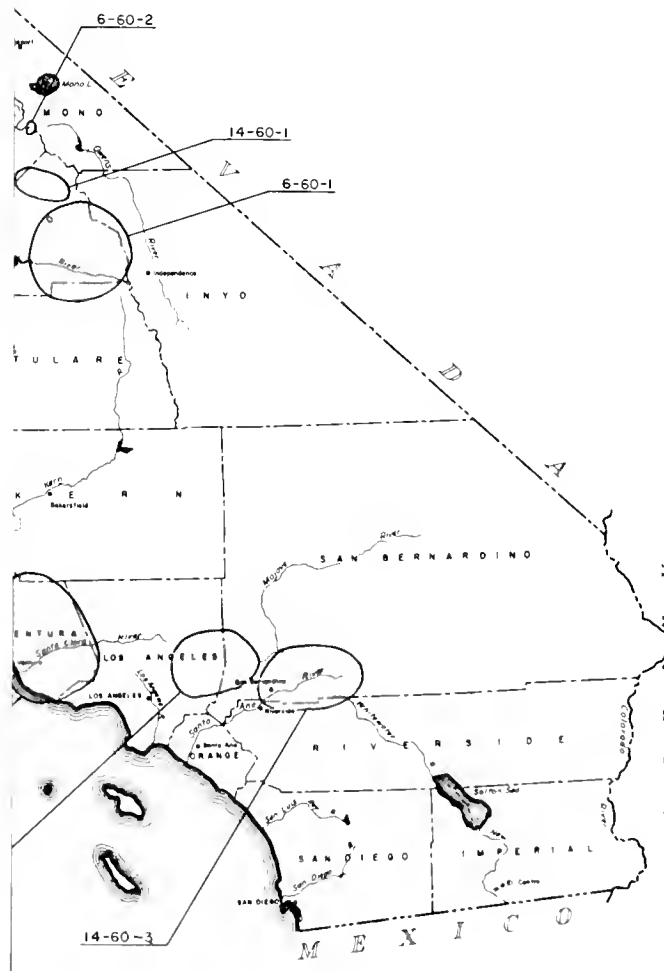
APPROXIMATE AREAS AFFECTED BY WEATHER MODIFICATION OPERATIONS

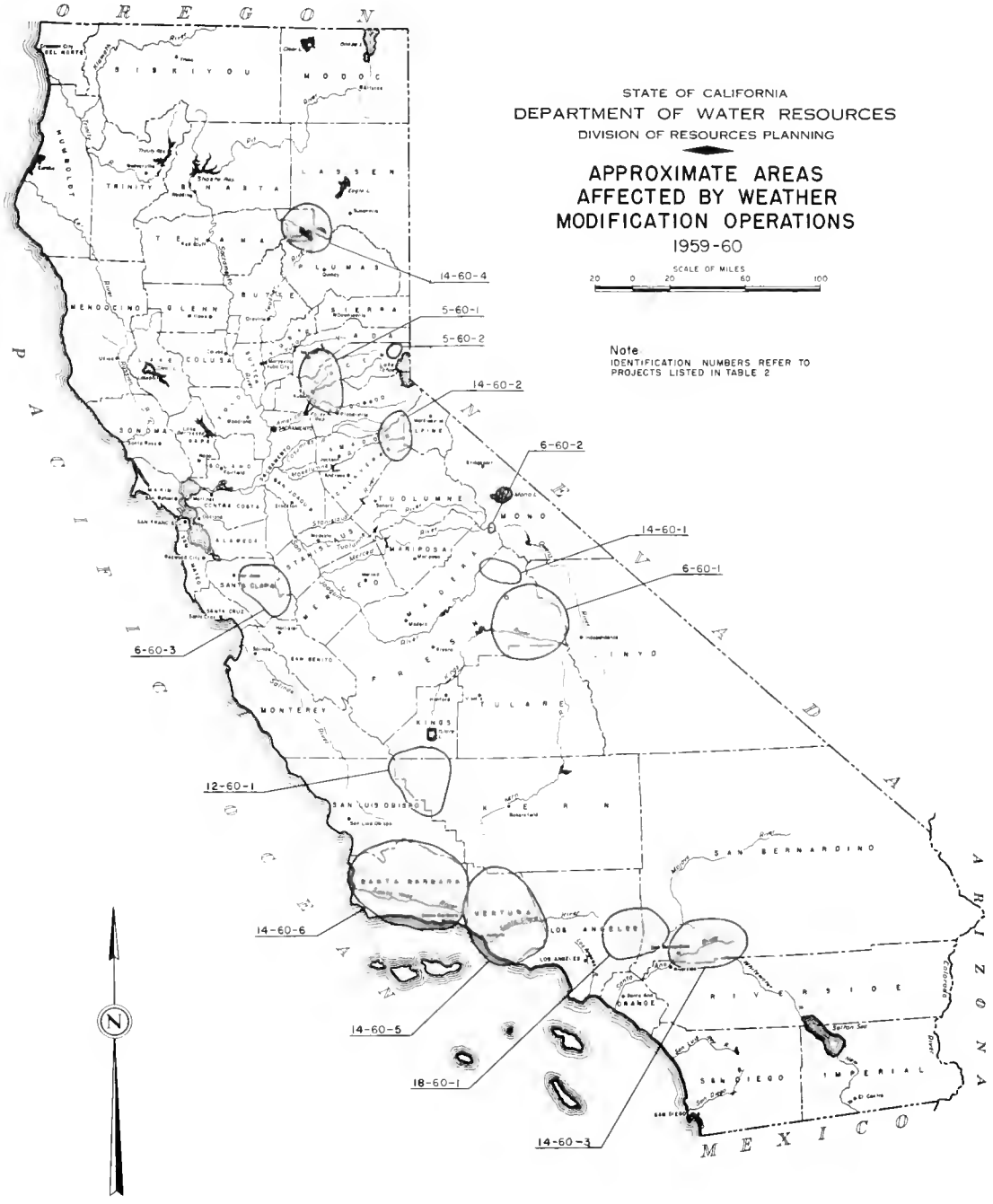
1959-60

SCALE OF MILES

20 0 20 60 100

Note.
IDENTIFICATION NUMBERS REFER TO PROJECTS LISTED IN TABLE 2




O R E G O N
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING
APPROXIMATE AREAS
AFFECTED BY WEATHER
MODIFICATION OPERATIONS
1959-60
SCALE OF MILES
20 0 20 60 100
Note
IDENTIFICATION NUMBERS REFER TO
PROJECTS LISTED IN TABLE 2
14-60-4
5-60-1
5-60-2
14-60-2
6-60-2
14-60-1
6-60-1
6-60-3
12-60-1
14-60-6
14-60-5
18-60-1
14-60-3
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INYO
KERN
SAN LUIS OBISPO
SANTA BARBARA
VENTURA
LOS ANGELES
SAN BERNARDINO
RIVERSIDE
SAN DIEGO
IMPERIAL
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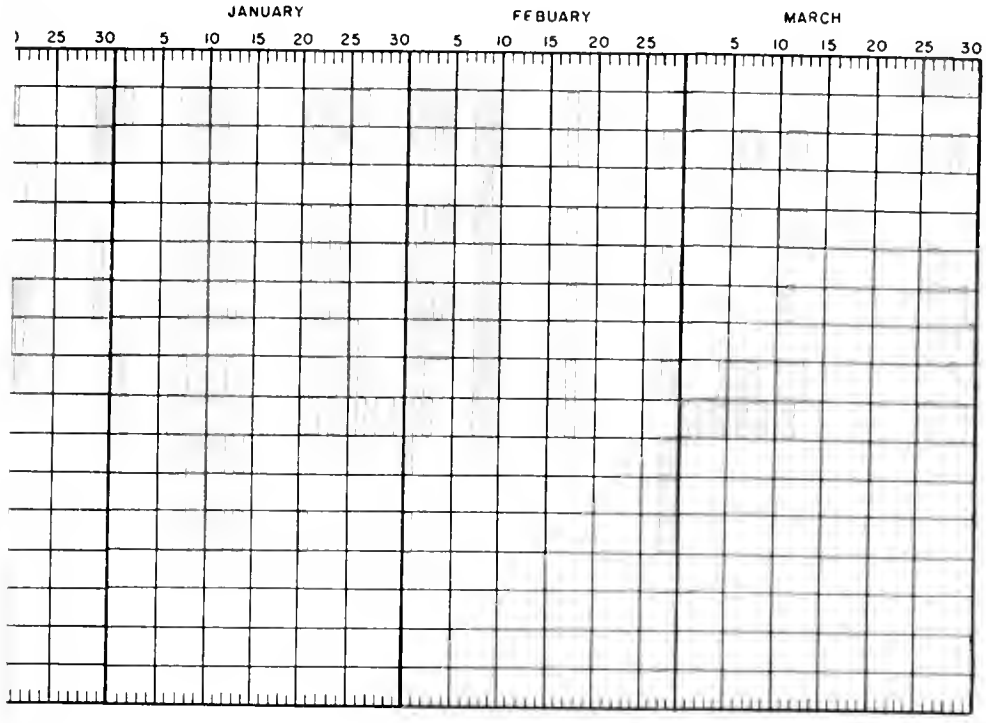
PACIFIC OCEAN
NEVADA
ARIZONA
MEXICO



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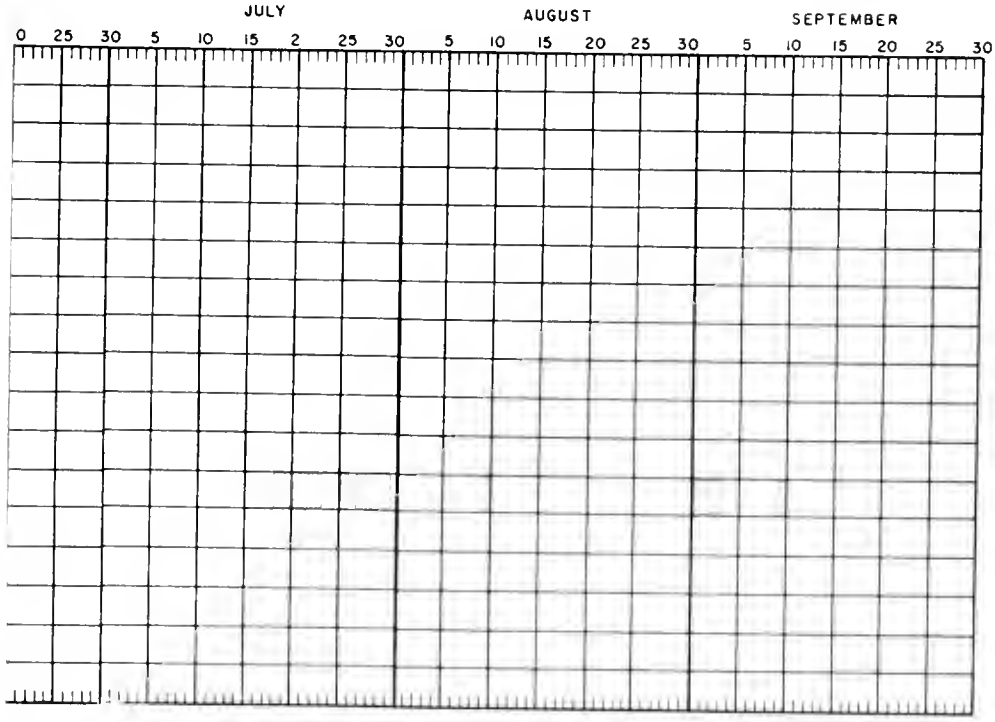

1960

MODIFICATION OPERATIONS

JGH SEPTEMBER 1960

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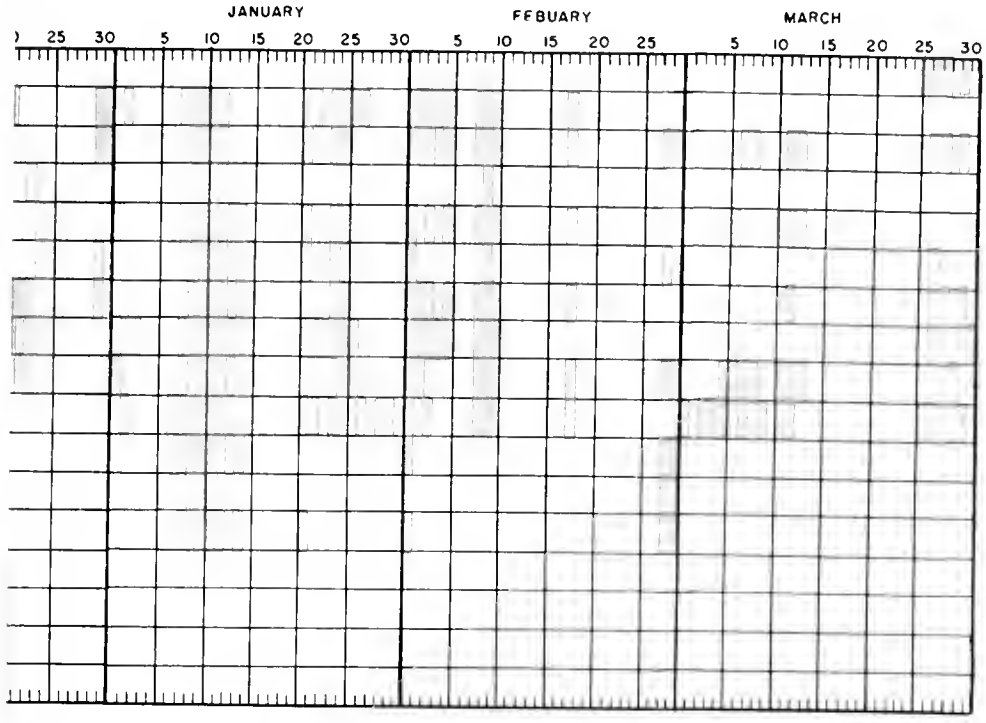

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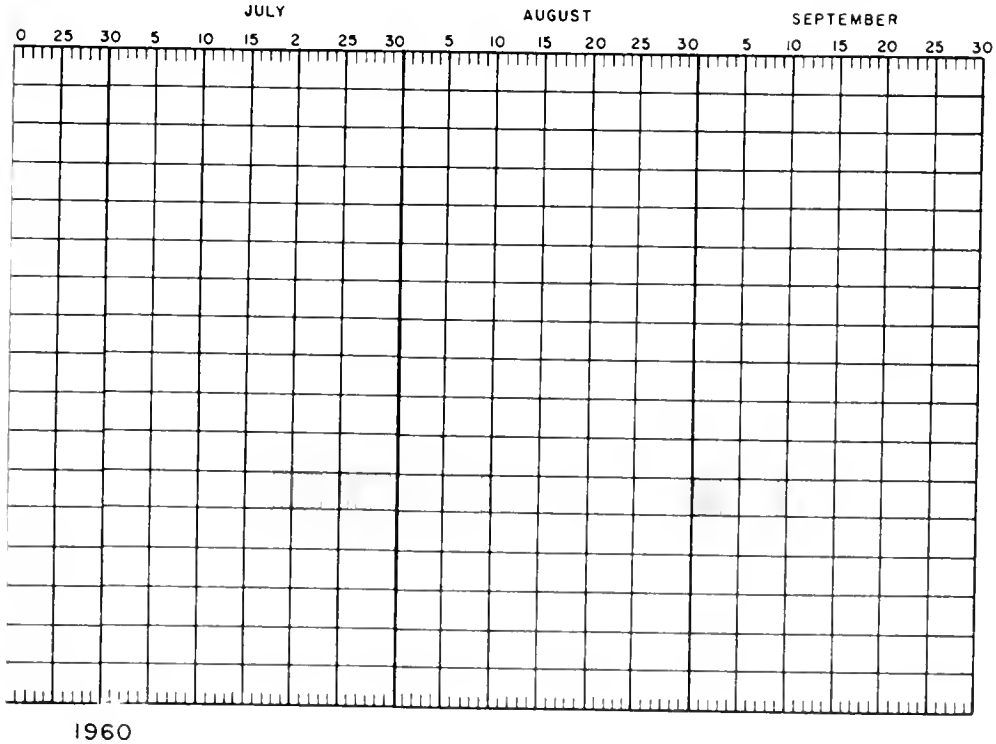

1960

MODIFICATION OPERATIONS

JGH SEPTEMBER 1960

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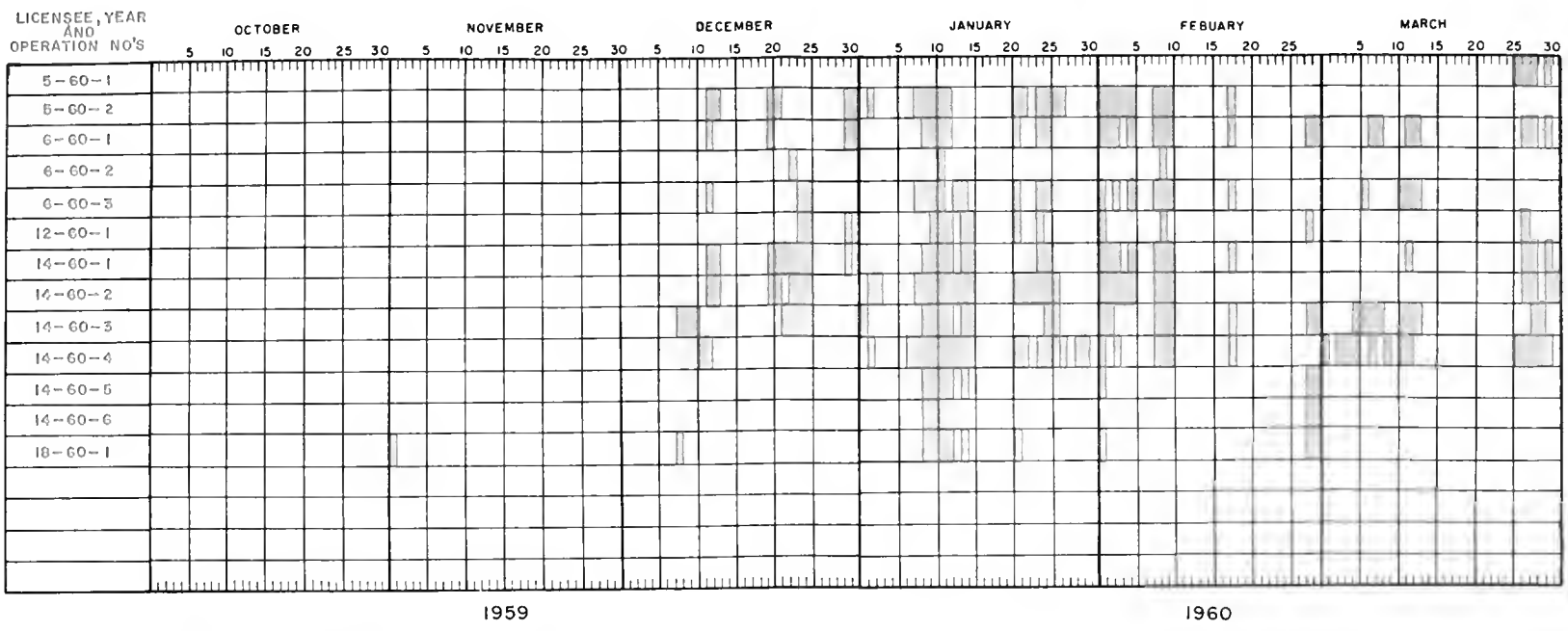

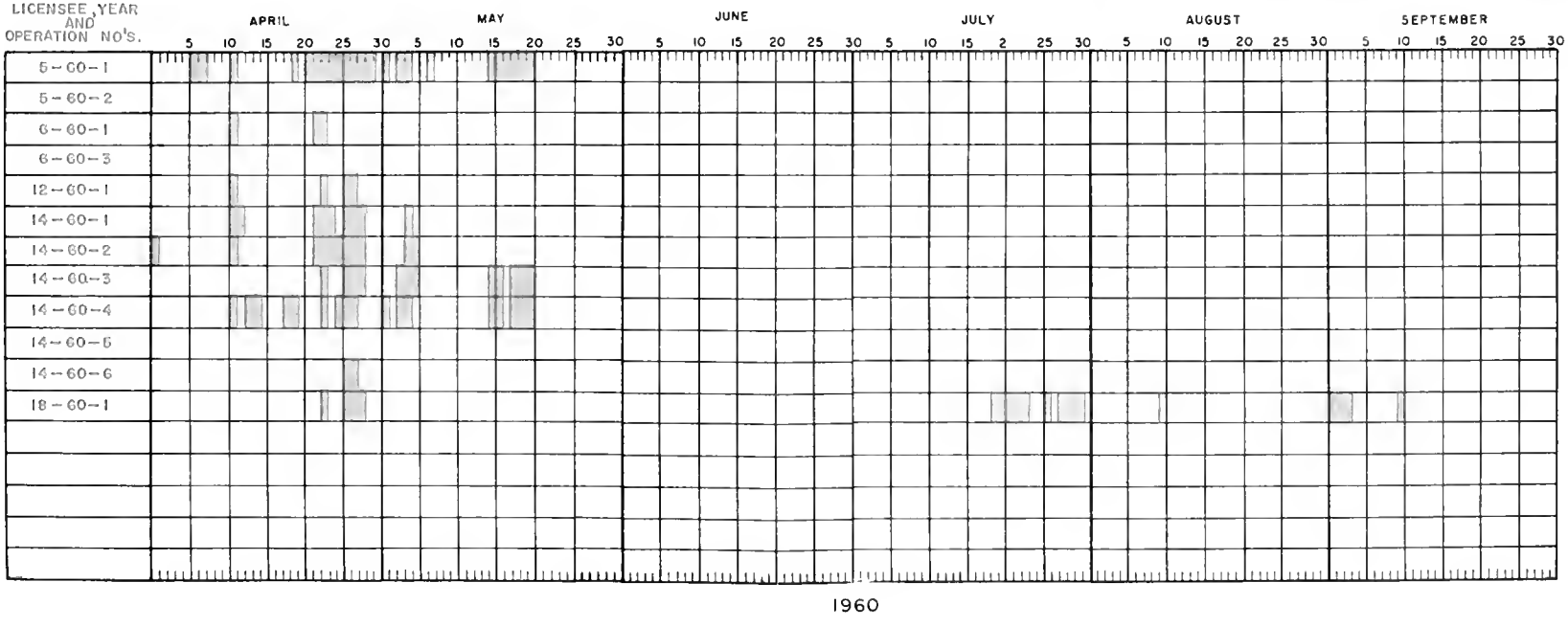

CALENDAR OF WEATHER MODIFICATION OPERATIONS

OCTOBER 1959 THROUGH SEPTEMBER 1960

DAYS OF CLOUD SEEDING SHOWN IN COLOR

DEPARTMENT OF WATER RESOURCES 1960

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Department of Water Resources

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WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

OCTOBER 1960 - SEPTEMBER 1961

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State of California

WILLIAM E. WARNE
Administrator
The Resources Agency of California
and Director
Department of Water Resources

State of California

The Resources Agency of California

Department of Water Resources

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA

OCTOBER 1960 - SEPTEMBER 1961

FEBRUARY 1962

Edmund G. Brown
Governor
State of California

William E. Warne
Administrator
The Resources Agency of California
and Director
Department of Water Resources

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PLATES

Plate Number	
1	APPROXIMATE TARGET AREAS OF WEATHER MODIFICATION OPERATIONS, 1960-61
2	CALENDAR OF WEATHER MODIFICATION OPERATIONS, OCTOBER 1960 THROUGH SEPTEMBER 1961

EDMUND G. BROWN
GOVERNOR

WILLIAM E. WARNE
DIRECTOR

ADDRESS REPLY TO
P. O. BOX 388 SACRAMENTO 2
1120 N STREET HICKORY 5-4711

STATE OF CALIFORNIA

Department of Water Resources

SACRAMENTO

February 1, 1962

Honorable Edmund G. Brown, Governor
and Members of the Legislature of the
State of California

Gentlemen:

I have the honor to transmit herewith a report of the Department of Water Resources entitled "Weather Modification Operations in California, as Reported to the Department of Water Resources, October 1960 - September 1961".

During the period covered by the report, there were ten projects involving weather modification operations which were undertaken in California. These were accomplished by nine of the eleven operators who were licensed by the department for such activities.

Sincerely yours,

William E. Warne

Director

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1960 THROUGH SEPTEMBER 1961

INTRODUCTION

In July 1951, the State Legislature enacted Chapter 1677, Statutes of 1951, for the regulation and licensing of weather modification in the State of California. This act, which has since been codified as Chapter 4, Division 1, of the Water Code, provides that:

> "No person, without first securing a license from the department shall cause or attempt to cause condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere, or shall prevent, or attempt to prevent by artificial means the natural condensation or precipitation of rain, snow, moisture, or water in any form contained in the atmosphere".

Once a license is obtained, the licensee is free to operate at any time or place he chooses, provided he follows certain regulations pertaining to public notification. At the conclusion of each of their weather modification projects, licensees are required by law to submit a completion report to the Department of Water Resources. These reports include such information as the name of the agency sponsoring the project, location of the project, log of all seeding operations, cloud-seeding techniques and type of equipment used, and the names of all persons who assisted in the operation. These completion reports submitted by the licensees are summarized by the department in an annual report on weather modification operations in California. This report, which is the sixth in the series, summarizes completion reports on all operations conducted in the State during the period of October 1, 1960, through September 30, 1961.

A complete record of weather modification operations since 1951 (the year legislative action began the licensing and regulating of operations) is available in the files of the department. In addition, a detailed report dealing with the theory of weather modification, evaluation of methods and results, and a history of cloud-seeding operations from 1947 through 1952 was published as Bulletin No. 16, "Weather Modification Operations in California", in June 1955, by the State Water Resources Board. Subsequent summaries of weather modification operations in California have been published by the Department of Water Resources as follows:

July 1952 - June 1956	Weather Modification Operations in California - January 1957
July 1956 - June 1957	Weather Modification Operations in California - July 1958
July 1957 - September 1958	Weather Modification Operations in California - July 1959
October 1958 - September 1959	Weather Modification Operations in California - February 1960
October 1959 - September 1960	Weather Modification Operations in California - December 1960

SUMMARY OF 1960-61 OPERATIONS

During the period covered by this report (October 1960 through September 1961) ten weather modification operations were conducted. These were included in that portion of the State from Plumas County in the north to Riverside County in the south. Of the ten cloud-seeding projects, eight were for the stated purpose of increasing precipitation, one was for dispersing fog, and one

was for suppressing hail. Four of these operations were concentrated along the western slope of the Sierra Nevada for the purpose of increasing precipitation on watersheds above hydroelectric installations. Precipitation increase was also the purpose of the two seeding projects in Southern California. Approximate areas affected by cloud-seeding operations during 1960-61 are shown on Plate 1.

The year covered by this report was an extremely dry one, hence the opportunity for seeding operations was limited. Total estimated operating time on all projects was 15,555 generator-hours. All projects used silver iodide as a nucleating agent except for one operator's use of "dry ice" (solidified carbon dioxide) in airborne generators. During the year, an estimated 264,100 grams, or 607 pounds, of silver iodide and 2,025 pounds of "dry ice" were released.

The amount of silver iodide released during the 1960-61 season was 84 percent of that released during the previous 1959-60 season. Total operating time during the 1960-61 season, however, was only 52 percent of the previous season's. Of the 365 calendar days during the year covered by this report, seeding operations were conducted on 108 days, as opposed to 107 days for the 1959-60 season.

The ten operations in 1960-61 were conducted by nine of the eleven licensed contractors. During the year covered by this report, one license expired and was not renewed and three new licenses were issued. Table 1 lists all licenses which were in force during the period.

Projects conducted in California during the 1960-61 season are listed in Table 2, together with pertinent data on number of generator-hours, rate of use of silver iodide, etc. Each project in the table is designated by a coding number consisting of three elements. The first element is the license number, the second indicates the water year, and the third is assigned in numerical sequence to projects undertaken by a licensee during the year as shown by published notices of intention filed with the department. This code number is used to identify the project for which the daily cloud-seeding operations are shown on Plate 2, and for which the approximate target areas are shown on Plate 1.

TABLE I

HOLDERS OF WEATHER MODIFICATION LICENSES FOR OPERATION DURING THE PERIOD FROM OCTOBER 1960 THROUGH SEPTEMBER 1961

License number	Licensee
1	North American Weather Consultants Santa Barbara Municipal Airport Goleta, California
5	Water Resources Development Corporation 460 South Broadway Denver 9, Colorado
6	Weather Modification Company San Jose Municipal Airport San Jose 10, California
12	Precipitation Control Company of California 105 Pierce Street Taft, California
14	North American Weather Consultants of California Santa Barbara Municipal Airport Goleta, California
17	Department of Natural Resources Division of Forestry Office Building No. 1 Sacramento 14, California
18	Los Angeles County Flood Control District Box 2418, Terminal Annex Los Angeles 54, California
20	International Weather Control, Inc.* 40 West First Street Reno, Nevada
21	Atmospherics Incorporated 3796 East Austin Way Fresno 26, California
22	San Bernardino Valley Municipal Water District** 384 West Fourth Street San Bernardino, California

* License expired December 31, 1960.
** License issued August 8, 1960

License number	Licensee
23	Pacific Gas and Electric Company*** 245 Market Street San Francisco 6, California
24	International Weather Control, Inc.**** 40 West First Street, Suite 105 Reno, Nevada

*** License issued October 18, 1960
**** License issued April 18, 1961

TABLE 2

WEATHER MODIFICATION OPERATIONS IN CALIFORNIA
OCTOBER 1, 1960 - SEPTEMBER 30, 1961

Project number	Licensee	Client	Target area	Period of operation	Rate of use of silver iodide: of grams per hour		Total generator hours:		Purpose
					Ground-based	Air-borne	Ground	Air	
5-61-1	Water Resources Development Corporation	Placer County Farm Labor Cooperative	Parts of Placer, Nevada and El Dorado Counties	Mar. 1, 1961 June 30, 1961	15.9*	220	4,780	186.2	Hail suppression
9-61-1	Weather Modification Company	Santa Clara Valley Water Conservation District	Santa Clara County	Dec. 1, 1960 Mar. 15, 1961	15.1*	45	701	9.1	Precipitation increase
13-61-1	Precipitation Control Company of California	County of Kern and landowners in area	Northwest corner of Kern County	Oct. 20, 1960 May 1, 1961		41*		3.9	Precipitation increase
14-61-1	North American Weather Consultants of California	Southern California Edison Company	Upper San Joaquin River Basin	Oct. 1, 1960 Sept. 30, 1961	6.7		1,254		Precipitation increase
18-61-1	Los Angeles County Flood Control District	Los Angeles County Flood Control District	Drainage area above San Gabriel Dam	July 1, 1960 June 30, 1961	20.5		158		Precipitation increase
20-61-1	International Weather Control, Incorporated	International Weather Control, Incorporated	Coastal areas	Sept. 20, 1960 Jan. 1, 1961		**		0.35	Fog dispersal
21-61-1	Atmospherics, Incorporated	Kings River Conservation District	Kings River Basin above Pine Flat Reservoir	Oct. 1, 1960 May 15, 1961	9.3	***	2,645	****	Precipitation increase
22-61-1	San Bernardino Valley Municipal Water District	San Bernardino Valley Municipal Water District	Santa Ana River Watershed	Nov. 1, 1960 June 1, 1961	12.5		958		Precipitation increase
23-61-1	Pacific Gas and Electric Company	Pacific Gas and Electric Company	Lake Almanor-Butt Lake drainage area	Dec. 1, 1960 May 31, 1961	26.6		1,012		Precipitation increase
24-61-2		Pacific Gas and Electric Company	Stanislaus and Mokelumne River Basins	Nov. 1, 1960 May 31, 1961	26.6		1,815		Precipitation increase

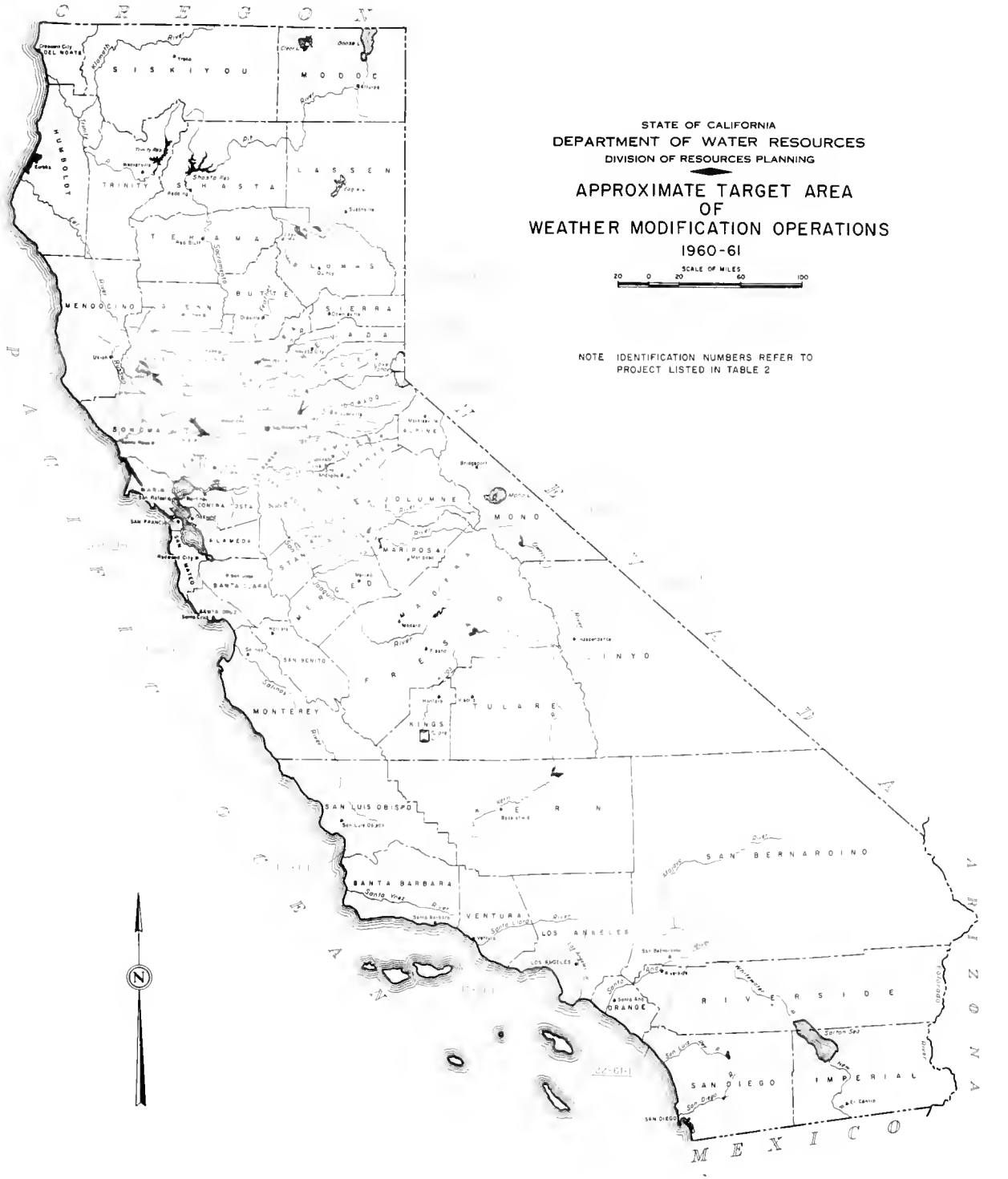
* Estimated weighted mean.
** Four gallons of solution of unspecified percentage used.
*** This operator used dry ice (CO_2 crystals) in place of silver iodide for air-borne operations. Total dry ice used was 2,025 pounds.
**** Total flights, 46. No time specified.

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE TARGET AREA OF WEATHER MODIFICATION OPERATIONS 1960-61

SCALE OF MILES
20 0 20 40 100

NOTE: IDENTIFICATION NUMBERS REFER TO PROJECT LISTED IN TABLE 2



STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
DIVISION OF RESOURCES PLANNING

APPROXIMATE TARGET AREA OF WEATHER MODIFICATION OPERATIONS 1960-61

SCALE OF MILES
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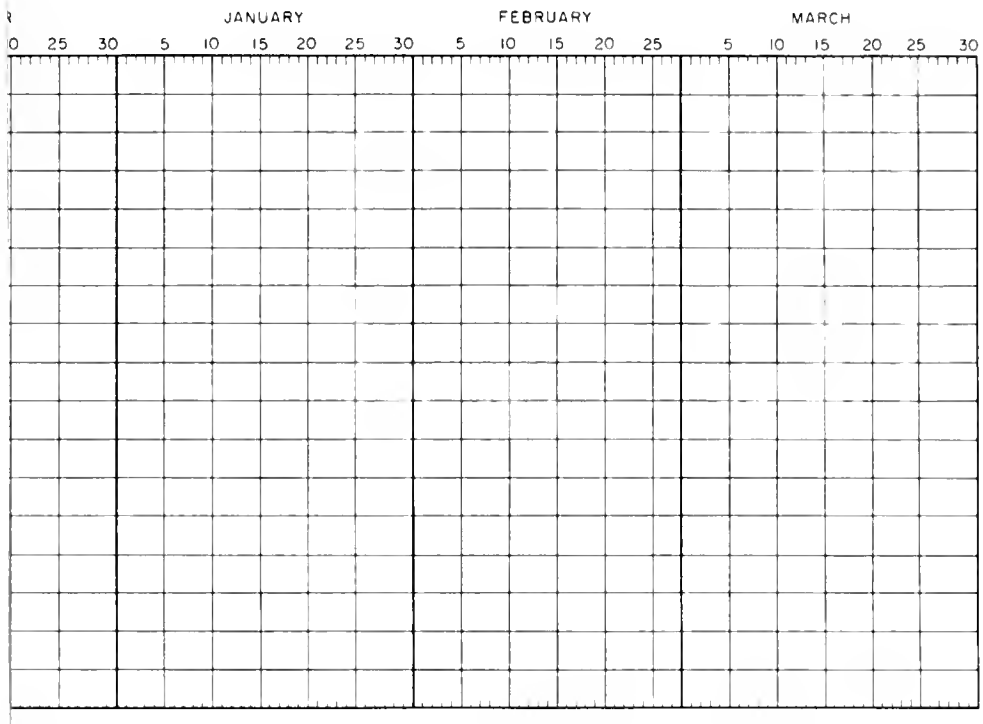
NOTE IDENTIFICATION NUMBERS REFER TO PROJECT LISTED IN TABLE 2



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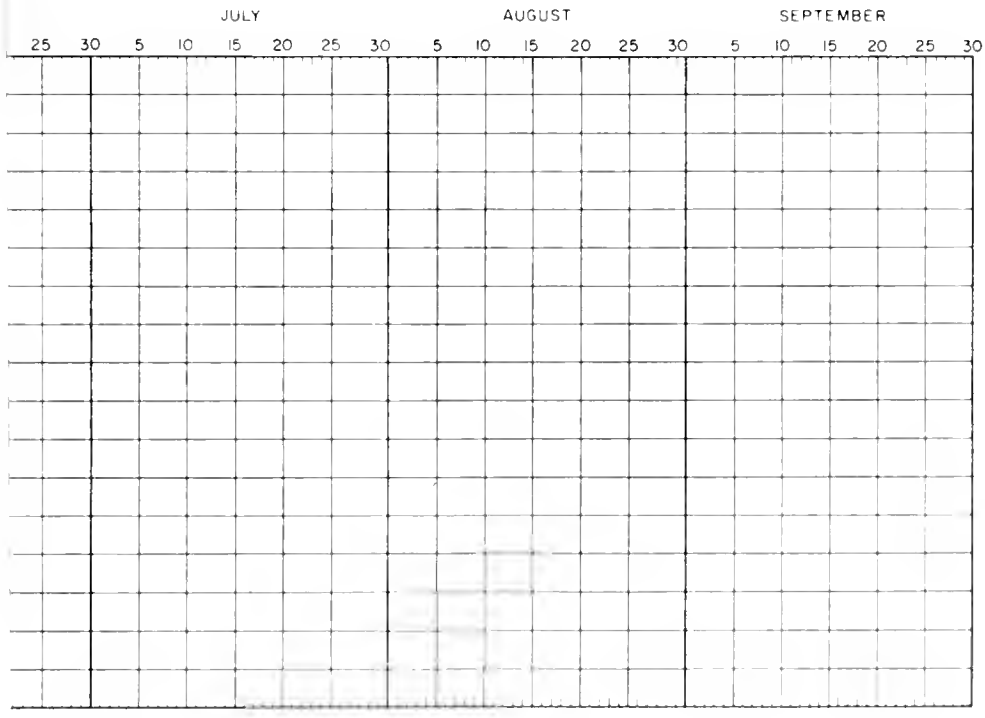
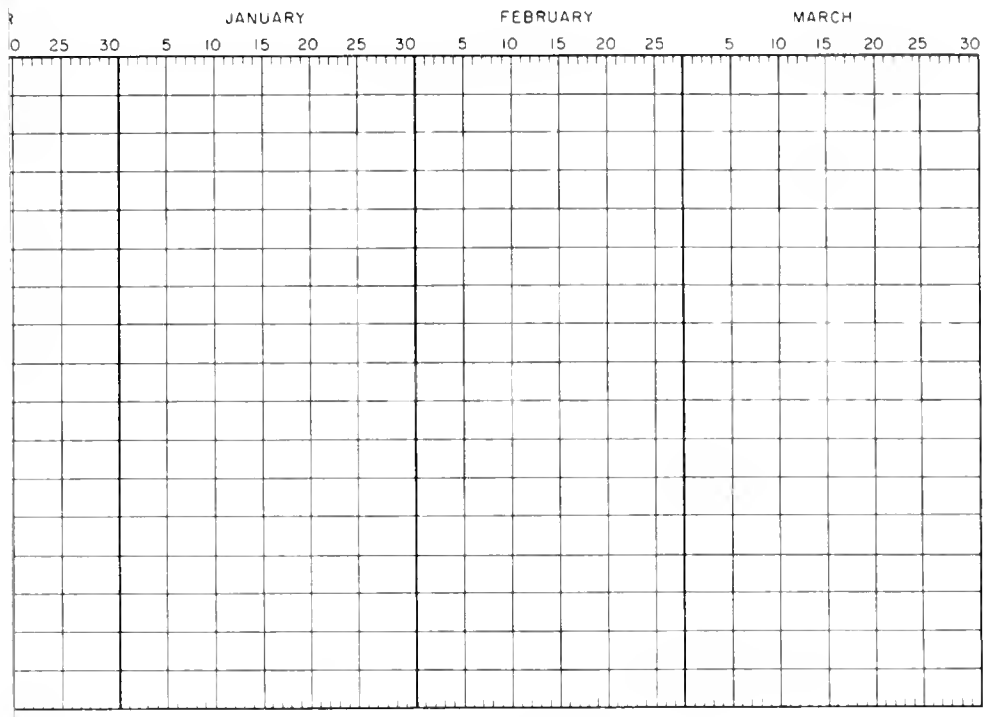


1961

ODIFICATION OPERATIONS

GH SEPTEMBER 1961

ING SHOWN IN COLOR



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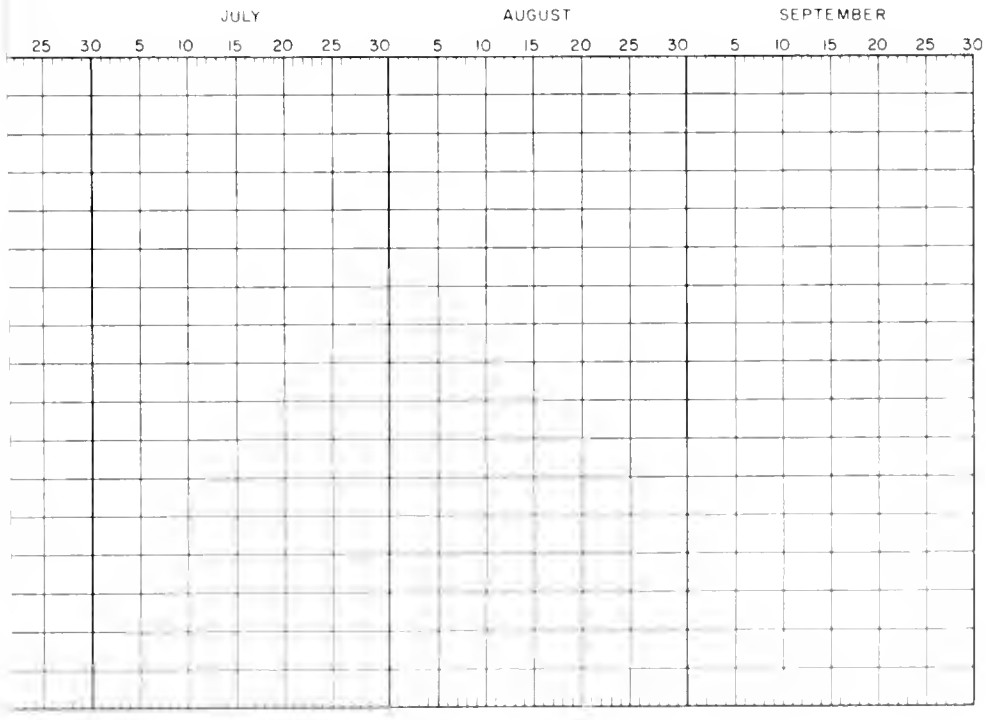

1961

ODIFICATION OPERATIONS

GH SEPTEMBER 1961

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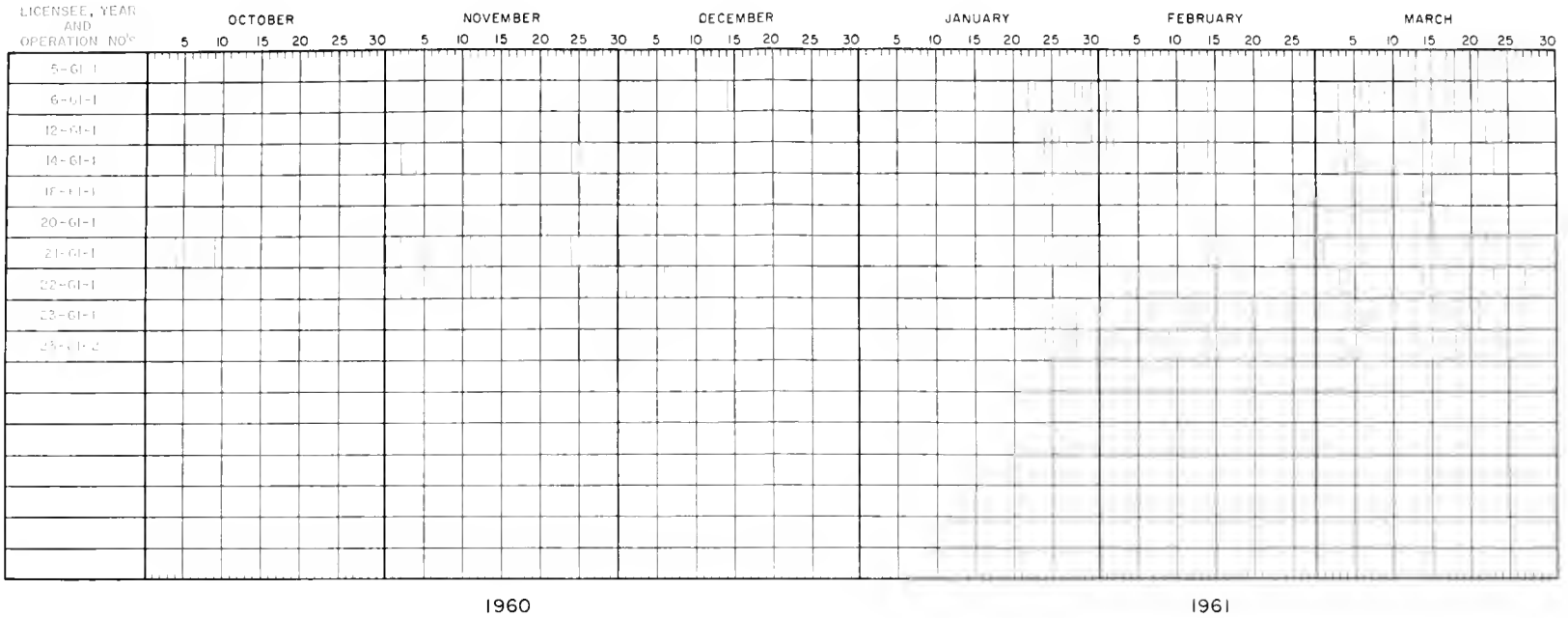

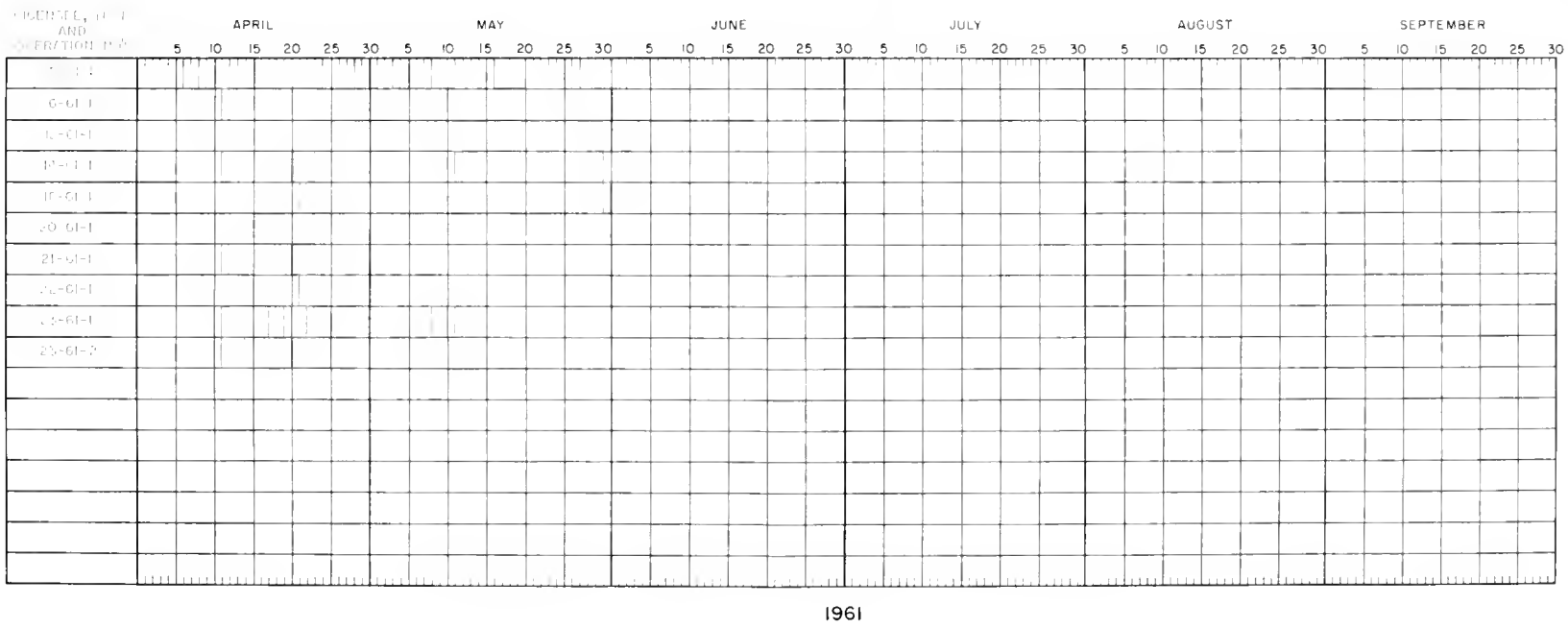

CALENDAR OF WEATHER MODIFICATION OPERATIONS

OCTOBER 1960 THROUGH SEPTEMBER 1961

DAYS OF CLOUD SEEDING SHOWN IN COLOR

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California. Dept. of Water Resources.
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